Electrical World

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The Power of an Industry

THE mobilization of the industry for Electrical Prosperity Week gives a new sense of the great power that it can exert. No one motive ever before brought together so successfully the different elements of our industry as the happy idea which has had expression this week. Although distinctively a trade movement, it was so plainly in the interest of all branches that no valid reason could be given for a failure to co-operate. For success it needed the hope of business profit which it promised. Yet it was much more than a purely mercenary movement. It reached into the realms of optimism and psychology and, by pointing to the white way of electrical prosperity, inspired and drew a remarkable volume of outside public support. Already reports indicate that Electrical Prosperity Week has far outrun the wildest hopes of the industry.

Regulation Under Political Pressure

POLITICS and commissions combine very unsatisfactorily. That is because the aims of politics are totally at variance with the spirit of ideal regulation. When succeeding administrations in New York State ousted the first members of the commissions they sowed the seeds for the harvest which they are reaping now. If the present members of the commissions shall be turned out of office for political reasons, their successors will find in turn the same fate. The unfortunate feature is that where such proceedings are tolerated the result is to put the commissions on a distinctly lower plane. Imminence of partisan attack does not foster the judicial frame of mind with which a commissioner should approach his problems. And the public which sees the offices treated as booty finds it difficult to regard the great work of regulation with the respect which is necessary if regulation is to be permanent.

Books That We Want to Read

BOOKS of the industry are usually reviewed in this order: Who is the author? What is he writing about? What has he said? How has he said it? and To whom is he writing? Stop and think of the "common denominator" of this long review "numerator," and we find it to be the word "he"—the man, the person, the human being who wrote the book. It sometimes seems to the reviewer as he reads the new lists of technical books and then digs into some subject upon which he would like more light that the authors ought to recognize the humanness of their average reader a bit more, that they ought to give their personalities a little play in what they write, and illumine their pages with a little more "he" and a little less "it." It is not safe to assume that a book—or an article, for that matter—is less accurate or less scientific because it is also more interesting than the average. Our technical literature as a whole is dreary. Occasionally we hit upon a book that we want to read. Is it necessary that we shall absorb most of our knowledge of our chosen profession because we must? Students in technical schools are not allowed to vote on this question.

The Panama-Pacific International Exposition

THIS week witnesses the close of the great Exposition on the shores of the Pacific. For almost a year it has stood as an ever-present reminder of the efficacy of faith. A marvel to herself, a miracle to the rest of the world, California refused to know calamity and reared a monument unique in the annals of expository art. So far as its contribution to science and industry is concerned, the Panama-Pacific International Exposition did not excel—the dogs of war precluded that. But it outstripped all others in beauty and, what is far more important, served as a cement to knit the East to the West and to unite the entire country in bonds of fellowship never before known. Nor was the Exposition without lasting effect on the professional world. The engineer received a wider conception of his vocation because of it, the artist saw his ideals reflected in its illuminated tablatures, and the scholar increased his knowledge of the world and its people. History will record how the Exposition was built in the face of deep depression, how the sacrifices made by the Pacific Coast States to insure its success were not made in vain, and how it closed in brilliant triumph with every lamp blazing to the glory of the colossal engineering achievement which it commemorated, to the lasting honor of the people of California, and to the credit of the brightest star in the firmament of nations, the United States of America.

Immunizing Boiler Metal

CHIEF among trouble makers in the operation of steam boilers is the material dissolved in or entrained by feed water. The first attempts to overcome troubles from this source involved the addition of various compounds to the water as it was pumped into the boiler, the object being to change the state of the scale-forming materials so that they could be removed by blowing-down and washing-out processes. The next

step toward the solution of the scale problem has been to carry out a chemical treatment of the water in a special apparatus previous to feeding it to the boiler. Both of these methods are successfully used at the present time. There is coming into use, however, a third method of attacking incrustation which differs from the others in that it is applied at the opposite pole of the difficulty, so to speak. Whereas all previous efforts had had the object of neutralizing trouble-making material in the feed water and of rendering the scale-forming substances harmless, this latest treatment ignores the composition of the water entirely. It goes at the metal with the purpose of rendering it immune from the effects of either acids or hard scale. No attention is paid to the water in the boiler except to use it as a vehicle by which the treating compound is brought into contact with the metal. The compound adheres to the tubes and forms a thin protective coating or film, thus making the deposits easily removable by ordinary methods. No additional labor is thereby required of the boiler-room force, nor are boilers cut out of service long for cleaning.

Our National Bureau of Standards

GOVERNMENT has seemed in the past to have little in common with business. If one spoke of government activities to the average man in control of the policies of his business, he held up his hands. Government activities so far as business is concerned have been largely regulative. This is not the place to speak for or against the necessity of regulative laws. The point is that, while labor has had its department looking out for the interests of labor, while the farmer has been served by a department looking for and finding ways of giving agricultural development constructive and merited assistance, there has existed at Washington no department which performed this sort of constructive work in general for business. The Department of Commerce, which so far as its name is concerned should rightly perform this function, is by law largely regulative in character. As a consequence every activity of this department is considered by the average business man to be regulative, to put hurdles in his way rather than to give him assistance.

The shining exception to this general lack of constructive assistance to business from the government is the Bureau of Standards, the work of which is described elsewhere in this issue. Here is an organized arm of the government, a body of men whose conception of their work is scientific, constructive and helpful, a branch whose possible service to industry in general and to the electrical industry in particular ought not to be handicapped by a misconception of its functions. The work of the bureau has been undertaken and prosecuted in a true scientific spirit. That conception has included not only the consideration of the technical sides of the problems, in which the bureau may be compared on an equal basis with any national institution in the world, but also the realization of the practical factors in the application of the solution of the particular problem. In spite of the meager appropriations at its disposal, the bureau has taken a place in constructive research which merits the attention of every thinking man in the industry, from the standpoint of what its work has meant for the electrical industry alone and for the example it has given of the possibilities of its larger opportunities in the nation's general program of preparedness for peace and war.

New Lamps for Old

AT the present time it is clear that the large gas-filled incandescent lamps are making inroads on the use of the arc lamp for street lighting. That incandescent lamps may entirely replace arc lamps is a possibility, but, as we have repeatedly contended in these columns, present indications are that both classes of lamps are likely to remain in use. In the long run it is efficiency that counts as a determining factor in the employment of any illuminant, and up to the present time the efficiency lies on the side of the large flaming and luminous arcs as against even the best of the incandescents. On the other hand, all the older types of arc lamps are certainly likely to disappear, and that speedily. Oblivion has long been overdue for the ordinary carbon arc lamps, especially those of the alternating-current type.

Let us look, however, at the situation as it exists from the standpoint of the central station. From a given plant there may be in operation several hundred old-fashioned arcs, say of the 6.6-amp. alternating-current type. These lamps consume about 425 watts each and give considerably less light than a properly installed 200-watt gas-filled incandescent. Where, from the economic standpoint, does the station stand, and would it be justified in pushing a replacement of one lamp by the other? Other things being equal, both station and consumer would clearly benefit by the change, for the one would have to supply less energy and stand less cost of attendance, and the other would be getting more light and steadier light. On the other hand, the station would have to make a considerable investment to effect the change, and the city might very properly ask a reduction of price on account of the great decrease in the amount of energy required. In rough terms, the saving in care of trimming and repairs for the arc lamp is of about the same order of magnitude as the cost of lamp renewals at the present expectation of life. Consequently these two items are a stand-off, and a balance must be struck between the provision of more light on the one hand and the consumption of less energy on the other, bearing in mind the amount of capital that must be invested in the newer incandescent lighting system.

From the general operating standpoint, the incandescent lamp has proved to be a great convenience, even though the renewal costs are quite comparable with the care and upkeep of an arc lamp. The incandescent lamp is either in service or out. There is no uncertainty about its starting, no bad performance until it is out of business. The incandescent never flickers, is in no way dependent for its performance on weather conditions,

and behaves in general with the utmost uniformity. All these characteristics make for good service and lessen for the supply company the difficulties of maintaining its street-lighting service in first-class working order. But when it comes to the use of powerful units for the most brilliant class of street lighting the high efficiency of the luminous and flaming arcs counts heavily, and, particularly as regards the former class, the white color is sometimes a material advantage. Not even the most efficient incandescent lamp gives a light approximating the tone of that from the magnetite arc. The main question in dealing with the substitution of the one illuminant for the other lies in the proper adjustment of the price for the incandescents. The company supplying them must obtain a suitable price for the energy supplied plus its cost of general service, and besides this must be able to make suitable provision for writing off the new investment. This last item is of considerable consequence, especially when ornamental fixtures are employed, as is often the case. As a result, the total cost of supplying the incandescent lamp, even figuring only a modest profit, rises to a figure not greatly below the cost of arc lighting where a wholesale change in the system is made, as in the typical case to which we have referred. In other words, one would seriously err in supposing that because the energy consumption for equal illumination is cut in half a similar ratio would hold for the equitable price of the two illuminants.

Another policy in change of service has perhaps much to recommend it; that is, the substitution for the arc lamp of an incandescent lamp taking substantially the same amount of energy without material change of price. This leaves the receipts of the supply company practically at the old figure but gives enormously better lighting in the streets. Unless a city is paying an abnormally large total for its street lighting, the change of service made in this particular way is perhaps the very best thing it can do so far as general results are concerned. The economic side of the situation is quite unsettled, and data for a complete solution of the problem are as yet scant. The situation is the more difficult owing to the fact that cities vary greatly in the relative bearing of the overhead charges on the street service. Where lamps are closely placed the distribution charges run low, while elsewhere with the same total number of lamps they may run outrageously high, owing to wide spacing, and the price necessary to cover the maintenance of circuits may seem abnormally great. One of the most useful pieces of work which the National Electric Light Association could do in this connection is a codification, so to speak, of the conditions existing where the change from arc to incandescent lamps has been made to give suitable data for equitable adjustment of prices. Street-lighting prices are always confusing, owing to the entrance of unlooked-for factors in reckoning them, and they are doubly so when, as now, a sudden change in system enters the computation.

Strength of Signals in Radiotelegraphy

FROM almost the earliest days of the wireless-telegraph art radio engineers have encountered the problem of selecting transmitter power and antenna height such that a continuously readable signal will be produced at some receiver installed a specific number of miles away. The inverse problem of predetermining the distance over which a given transmitter would be capable of signaling has also been ever present. The quantities of sending and receiving antenna heights, sending power, strength of received signals, and signaling distance have been considered as interdependent functions for many years; wave-length, form factor of antenna, natural frequency of aerial system, ratio of radiation to total antenna resistance, and "absorption" by the wave-traversed territory have been interlinked more recently. Marconi's law, of about 1900, stating that for identical simple vertical aerial wires the maximum signaling distance varied as the square of the antenna height, has been extended and embodied with otherwise developed expressions until we now have a large number of alleged quantitative interrelations between the quantities stated.

In spite of the large amount of speculation as to the theory of radio transmission, few comprehensive series of experiments have been made. The contractor's demonstrations of the apparatus supplied to the United States Navy for the high-powered radio station at Arlington, however, were made use of to obtain such quantitative results as would permit the establishment of a broadly inclusive set of functional relations between distance, wave-length, antenna currents and antenna heights. The expression reached by Dr. L. W. Austin and Mr. Louis Cohen from study of the test data has since been found sufficiently accurate to be useful in the computations preliminary to radio-station design.

The transmission equation thus developed and checked is, however, in such form that explicit algebraic solution for distance in terms of the other factors is not possible. Yet in a majority of problems soluble by use of this expression distance is the only unknown. The interesting graphical solution used at the Bremerton Navy Yard, published in this issue, should prove of assistance to those radio engineers who have occasion to make frequent use of the equation itself.

Editorial Announcement

IN this, the first issue of the month, appear articles bearing on the relations of the electrical industry with the public, the government, and the commissions. Last week, the monthly commercial number, was given over in large part to business-getting plans for the Electrical Prosperity Week and Christmas campaigns. Next week, in the issue regularly devoted each month to station and operating topics, will be published special articles on distribution and substation practice, the design of horn-gap fuses, etc. And, following the usual plan, the third issue of December will be devoted largely to engineering and technical development.

Flood-Lighting of the Historic Massachusetts State House, Boston, During Electrical Prosperity Week

With the coming of twilight on Monday evening, the Electrical Prosperity Week illumination of the Massachusetts State House at Boston was switched on for the first time, and nightly thereafter the unique spectacle of the great structure lighted from dome to foundations attracted the attention of throngs on all sides of the Common. The flood-lighting of the State House, which surpassed anything of the kind ever seen in the Hub, as Bostonians speak of their city, was carried out through the efforts of the Edison Electric Illuminating Company of Boston, which appropriated about $18,000 on its Prosperity Week celebrations in Boston and eastern Massachusetts.

The dome, the Bulfinch front and the newly completed wings of the building were illuminated, as though cut in cameo, by batteries of 16-in. projectors installed in two groups on adjacent structures, the reflectors being from 150 ft. to 400 ft. away from the capitol. Each consisted of a 500-watt gas-filled tungsten lamp, thirty-eight being mounted in one group and thirty-six in another. Each lamp threw a beam of 100,000 cp. at the source, a specially concentrated filament being used, with a few color screens in the batteries. This illumination of the historic building, which was continued nightly during the week, attracted a great amount of attention, and the conversation of crowds on the streets, even several blocks away from the display and out of sight of it, indicated that the widespread publicity of the week was effective.

A Chronicle of Events of the Industry and of Important Movements in the Field

NEWS OF THE WEEK

Reports of Conventions and Meetings of Electrical Associations and Societies

PROSPERITY WEEK CELEBRATIONS

Central Stations, Jobbers, Dealers and Contractors Report Increases in Business Directly Traceable to Campaign

During the present week Electrical Prosperity Week has been celebrated in every State in the Union. While full details of the local benefits of the campaign will not be known in every case for some time to come, the first reports have all expressed enthusiasm over the results of the nation-wide co-operative campaign.

President Woodrow Wilson in a letter to J. M. Wakeman, general manager of the Society for Electrical Development, commended the efforts of the society in its promotion of Electrical Prosperity Week as follows:

"I am glad to learn from your favor of the 11th instant that the Society for Electrical Development will celebrate Electrical Prosperity Week from Nov. 29 to Dec. 4 and to be advised that the object of this celebration is to create in the public mind a firm confidence in the business institutions of America.

"There can be few things of greater importance to the people of the United States than that they should have strong confidence in themselves and in the institutions and the industries which they have created. I earnestly commend the effort on your part to develop and maintain reliance by our people in their own ability to meet the problems of industrial and national life. Such a reliance may be wisely based on what we have achieved heretofore. With such a reliance we may look fearlessly to the future."

New York Jovians Celebrate

At the largest weekday luncheon of the New York Jovian League, held on Wednesday at the Hotel Martinique, J. M. Wakeman, general manager of the Society for Electrical Development, who was chairman of the day, stated that this week the Rotarians in 170 cities devoted their meeting to an Electrical Prosperity Week celebration. This, the speaker said, was the first time the Rotarians had ever devoted a session to a commercial discussion. On Wednesday, he further stated, Jovians in every important community in the country met to pay tribute to Electrical Prosperity Week. The real significance of Electrical Prosperity Week, the speaker added, was that the use of electricity means prosperity to the user. George McAneny, acting Mayor of New York City, who at the last minute was prevented from being present and speaking, in sending his regrets by Theodore Rosseau, secretary to Mayor Mitchel, said that "Electrical Prosperity Week symbolizes the prosperity of the country."

Dr. Delos F. Wilcox, deputy commissioner of the department of water supply, gas and electricity of the city of New York, was the principal speaker of the day, his topic being "The Importance of the Relation of Electricity to a Community." He stated how the health department had reckoned that the population of the city had increased 20 per cent in five years, while the State census gave but 7 per cent. He therefore tried to get at the city's growth by considering the growth in revenue of the city's public utilities, and the figures he found were as follows: Transit, 17 per cent; gas, 20 per cent; water, 7 per cent; electricity, 64 per cent.

The Rotarians of Atlantic City, N. J., held on Nov. 30 an electrical dinner and meeting under the chairmanship of Joseph A. Manee, vice-president of the Test Company of Atlantic City. H. C. Sterling, assistant manager of the Atlantic City Electric Company, made the principal address, in which he spoke of the Society for Electrical Development, its aims and purposes.

Simultaneously with a hundred or more other "rotary clubs" throughout the country the Cleveland (Ohio) Rotary Club devoted its meeting of Dec. 2 to a special Electrical Prosperity Week program. F. M. Feiker, editor of the ELECTRICAL WORLD, addressed the meeting on the subject "An Industry Plus."

Electrical Prosperity Week at Boston

A decided increase in business during the past fortnight as a result of Electrical Prosperity Week advertising has been noted by representative jobbers at Boston. V. C. D. Wetmore of the Wetmore-Savage Company states that the trade in electric-heating appliances has increased considerably, and George H. Wahn of the George H. Wahn Company says that the publicity campaign has stimulated the retail purchase of irons, percolators and flashlamps to three times the volume of two weeks ago. Herbert S. Potter, electrical contractor, notes a decided improvement in business within the past few weeks, although, with G. M. Stuart of the Stuart-Howland Company, he considers the present writing too early definitely to analyze the results of the campaign.

About $18,000 has been expended by the Edison Electric Illuminating Company of Boston, Mass., to help make Electrical Prosperity Week a success.

Just before the week began, the company sent special delivery packages of publicity matter to sixty hotels and thirty leading stores. Every one of the more than 2000 employees of the company, local press and mercantile organizations were supplied, while the newspapers, street cars, shop windows and display rooms of the company at its main office and district stores "ran" special advertisements. At the company's headquarters the main show window, illuminated by fourteen 100-watt gas-filled lamps, was fitted out as an electric kitchen, with frequent demonstrations on an electric range, washer, utility machine, etc. All theater programs carried Prosperity Week advertisements, and more than 6000 street cars in eastern Massachusetts announced the arrival of the week on their dashers. Daily luncheons and simple dinners were held for all employees of the operating bureau, with co-operative and Prosperity Week discussions. Every Edison truck carried a banner appropriately inscribed for the week, and on Tuesday an electric-vehicle parade was scheduled in which about eighty trucks entered. This was followed by a dinner of electric-vehicle interests at the Hotel Thorndike in the evening. S. G. Thompson of the Public Service Electric Company of New Jersey was the speaker.

The United Electric Light & Power Company of New York City is "cashing in" on the campaign. The total sales for Saturday, Monday and Tuesday were $600 greater than the total sales of the previous week. The company's entire celebration is devoted to the Washington Heights district, where the windows of fourteen electrical contractors have been decorated all alike by an expert employed at the company's expense. Twenty-four electric vehicles carrying large "E. P. W." signs constantly paraded the streets. Eleven moving-picture houses twice a night threw an "E. P. W." sign on the screen. The branch office was outlined in light and decorated with flags and festoons. From the roof flew a kite to which was suspended a 40-ft. banner proclaiming, "This Is Electrical Prosperity Week." A large electric sign at 181st Street and St. Nicholas Avenue told the date of Prosperity Week. During the celebration the company offered to its customers reduced prices on four appliances: an electric lamp was reduced from $15 to $9.98, an electric percolator from $5 to $4.49, a toaster from $3.70 to $2.98, and a flatiron from $3 to $1.98. These offerings were made in conjunction with the fourteen contractors, who received their stock from the company, the profit going to them. By Tuesday night all fourteen were sold out and had placed renewal orders. Joseph F. Becker, commercial manager of the company, said: "We are doing a land-office business."

One of the large manufacturers of electric lamps stated that Electrical Prosperity Week had greatly increased the sale of its special projector lamps for flood-lighting.

PROSPERITY WEEK LUNCHEON OF NEW YORK JOVIAN LEAGUE

PLANNING FOR PROSPERITY WEEK

How the Society for Electrical Development Prepared the Country for the Great Trade Celebration

During the week from Nov. 29 to Dec. 4 the electrical industry of the United States, from border to border and coast to coast, brought into being the plans already carefully laid for a successful celebration of Electrical Prosperity Week. While the local plans were left to the local committees, the national campaign was directed by the Society for Electrical Development from its office in New York. Although the idea of a national exploitation of electricity is not a new one, this is the first national electrical campaign that has gone further than a mere discussion.

The idea for the celebration which has just been held was conceived at a meeting of the interests composing the society on Friday, Jan. 8, 1915, when among other matters plans for a great national sales and educational week were discussed. Tentative plans were adopted subject to the approval of the society's board of directors, and the name of the week became temporarily "National Electrical Week."

Weekly and semi-weekly meetings were held with the editors of the trade press and others, and unofficially with certain of the directors of the society. The plans were then formally submitted to the directors of the society, who approved of them, together with a budget of $50,000 to carry on the work. The budget was carefully prepared in co-operation with many leading advertising men engaged in national publicity work. Since that time there has been voted approximately $10,000 additional to take care of advertisements run in two large national weeklies. It has been estimated that the cost of the week to the entire electrical industry for advertising, campaigns, etc., was not less than $500,000. At the annual meeting of the society held on May 11 the advanced plans for the week were approved and the actual work on the campaign was started. Previous to this meeting the activities of the society had been spent in discussions regarding what to do in the campaign, what to name the week, and when to hold it. After considering suggestions for holding the week anywhere from spring to fall, the date Nov. 29-Dec. 4 was decided on.

Material Furnished by Society

To give an idea of the quantity of co-operative material and circulars issued by the society for Electrical Prosperity Week, the following figures were compiled. They include only typical Electrical Prosperity Week matter, and of that matter only such items as were mailed to the entire or to certain definite sections of the mailing list. This means that the list does not include advertising-service folders, window-display suggestions, the "Facts" folder, electrical pages, 5000 reprints from the ELECTRICAL WORLD, the sample proclamation, the letter from the conference mayors, the monthly display suggestions and similar literature, and several other items that were produced for use during the campaign but which were not mailed broadcast.

The figures are: 35,000 plan booklets, 16,000 reprints of the article in *Printer's Ink*, 25,000 electrotype service folders, 30,000 advance descriptions of co-operative material folders, 75,000 *Exciters*, 18,000 "E. P. W." display folders, 15,000 bill-poster folders, 35,000 two-color folders showing "E. P. W." material, 20,000 four-page newspaper-advertising folders, 30,000 proofs of *Saturday Evening Post* and *Collier's Weekly* advertisements, 20,000 "electurette" sheets, 20,000 electrical-page filler-material sheets, and 20,000 "Important Announcement" leaflets.

There were 76,000 "How to" booklets sent out as follows: 7000 central station, 17,000 dealer and contractor, 10,000 electric show and demonstration, 10,000 slogan sign, 11,000 electric-vehicle parade and "sociability" run, 10,000 ornamental lighting, and 11,000 reprints of the "Float" article in *Electrical Merchandise*.

The total of the above figures—425,000—does not represent the number of pieces mailed, as in some cases two, three or four were mailed under one cover. On the other hand, order blanks, post cards and the like have not been considered.

One way to figure the total number of pieces of mail sent out is to take the number of envelopes ordered during the campaign, which was 232,500. To this must be added 41,000 wrappers used for the two issues of the *Exciter*, making a total of 273,000. A total of 125,000 letterheads were printed.

Of the material which was provided to enable local organizations, companies and committees to celebrate Electrical Prosperity Week, the following quantities were produced: 5000 eight-sheet bill posters, 27,500 24-in. by 32-in. window lithographs, 20,600 four-color car cards, 2000 two-color car cards, 26,500 four-color window cards 11 in. by 21 in., 2500 two-color window cards 11 in. by 21 in., 30,000 two-color window cards 7.5 in. by 13 in., 9500 muslin signs 24 in. by 48 in., 5,000,000 poster stamps, 2,000,000 folders for the public, 5000 electrotypes, and 600 "movie" slides—a total of 7,129,-200 pieces.

A total of 2300 orders for "E. P. W." material were received, and 5000 packages were shipped. Members of the society's staff received a great many calls to speak before local meetings on the national plans for the week and to tell how the local merchants by co-operation could "cash in." It has been said that staff speeches were made in almost every State of the Union. With few exceptions the society provided all the tools which the local interests needed in order to map out their campaigns effectively.

J. M. Wakeman, general manager of the Society for Electrical Development, in a signed statement to the ELECTRICAL WORLD, says:

"The success of the Electrical Prosperity Week campaign has been beyond the expectation of anyone connected with its conception. Uninformed indeed is the man in the electrical industry who does not know about this great trade movement—the greatest in the history of the country.

"This tremendous success is due to the initiative of the Society for Electrical Development, to the intelligent activities of its staff, to the whole-hearted co-operation of the local committees, to the interest evinced by the electrical fraternity everywhere, whether members of the society or not, and, still more than to any of these,

The Exciter
How Your City Can Plan A Profitable "Cash In" Celebration for Electrical Prosperity Week
What 8 Great Men Did For Electricity
E-LECTURETTES
The Exciter
The time is getting pretty short
Order now!
Electrify Yourtown
Electrical Page Service
MILLIONS OF PEOPLE
How One City has planned a Profitable Celebration
Proclamation
The Speeder-Up
THE DEALER CONTRACTOR CASH IN

SAMPLES OF ELECTRICAL PAGES, PAMPHLETS, CIRCULARS AND OTHER PUBLICITY AND SALES-HELP MATERIAL FURNISHED BY THE SOCIETY FOR ELECTRICAL DEVELOPMENT

A UNITED ELECTRIC COMPANY SIGN AT NEW YORK

PROSPERITY WEEK ELECTRIC-VEHICLE PARADE AT BOSTON

to the wonderful co-operation rendered by the daily press, the popular magazines, the technical and the trade press throughout the entire United States. This co-operation was ungrudgingly given because of the well-recognized fact that Electrical Prosperity Week, besides being planned for the benefit of the electrical industry, had a higher object to attain. At a time when the whole world was swamped under a tidal wave of pessimism the Society for Electrical Development struck a note of optimism, and this note has been sustained throughout the campaign. It has inspired and enlisted the support of governors of states, mayors of cities, boards of trade, chambers of commerce and other industrial organizations from Maine to California, from the Gulf up to and extending into the Dominion of Canada.

"Electrical Prosperity Week has brought home forcibly to the entire nation the immense influence which electricity in its manifold uses exerts upon daily life and contributes to the effective working of civilization."

STATE OF AMERICAN BUSINESS UNITS

Vice-Chairman Hurley of the Federal Trade Commission Gives Significant Facts Gleaned from Commission's Records

At the annual meeting of the Association of National Advertisers, held in New York on Wednesday, Edward N. Hurley, vice-chairman of the Federal Trade Commission, told of the work of the commission and of its anxiety to help business. One of the ways devised has been to collect and make known the essential data regarding business. Although incomplete, the information gathered is significant. Leaving out of consideration the banking, railroad and public utilities corporations, and referring only to those that have to do with trade and industry, the commission found that there are about 250,000 business corporations in the country. Of those, over 100,000 have no net income whatever; 90,000 make less than $5,000 a year, while the 60,000 remaining make $5,000 a year and over.

Turning from net income to the total volume of business done by these latter 60,000 corporations, it develops that 20,000 have annual sales of less than $100,000, 20,000 more sell from $100,000 to $250,000, 10,000 additional from $250,000 to $500,000; 5000 corporations ship annually $500,000 to $1,000,000 worth of goods, 4500 have total sales from $1,000,000 to $5,000,000, while only 462 industrial and mercantile corporations in the United States do an annual business of $5,000,000 or more.

These figures show that big business, while important, constitutes but a small fraction of the trade and industry of the United States. They make clear that there is a large proportion of unsuccessful business concerns. The questions that Mr. Hurley asks are: Do they not need help? Why have we not paid more attention to small and middle-sized business? Is it not worthy of our consideration? What measures are we to take to improve these conditions?

The speaker said that the real, constructive help must come from within. The need is for better business methods. The day of large profits is past, and business men now have to get down to the hard facts of business, to learn precisely what they are, where the weaknesses and losses exist, and practice the same thoroughness which characterizes trade and industry in Europe. A study of standard systems of bookkeeping and cost accounting is imperative.

Need of Accounting System

Many of the larger manufacturers have thorough cost-accounting systems, which they recognize as necessary in order to give them the information essential to successful management. On the other hand, Mr. Hurley said, the number of smaller manufacturers who have no adequate cost-accounting system and who price their goods arbitrarily is amazing.

Whole industries in many instances are suffering from a general lack of intelligent knowledge of cost, yet how can the Federal Trade Commission help to cure these conditions? The commission has no power and no desire to use compulsory methods, but it does hope to reach the desired end by indorsing standard systems of bookkeeping and cost accounting, and to assist in devising standard systems, either at the request of individual merchants and manufacturers or through the association that represents the industry. The commission expects to have for this work an adequate force of experienced accountants and cost experts, and the service, in an advisory capacity, of public accountants of national reputation. In this way individual enterprises will be helped and prices established on a solid basis of fact.

An effective system of accounting will enable the banker to extend to the smaller manufacturer the credit to which he is entitled and which he needs in order to expand his business. The small manufacturer may have just as much brains, ability, knowledge of his wares and of his customers as the larger operator; he may even put out a superior product. But he cannot show the banker a balance sheet based on proper accounting methods, and the banker does not feel ready to extend credit without the knowledge that such a balance sheet would supply; thus, because business men of this type cannot give statements about their business affairs in the exact manner necessarily required by the bankers, their credit is restricted and their expansion checked.

There should be a greater degree of organization and of mutual helpfulness in all lines of trade and industry, according to Mr. Hurley, so that American business may be welded into a commercial and industrial whole. One of the most effective forms of organization, the speaker said, is the trade association. The association has a wide field of useful and proper activities. Concerns in the same industry may take common action looking toward improving their processes of manufacture, standardizing their product, improving their system of ascertaining costs, obtaining credit information, and encouraging the development of trade journals. The welfare of employees is one of the important matters which can be best developed by co-operating in associations. The present tendency of the larger firms to think of the smaller man in the proper spirit and to assist him in arriving at some practical method of ascertaining his costs and meeting his many other problems—in short, to live and let live—is to be particularly commended.

Associations of manufacturers, associations of jobbers, associations of merchants, associations of advertisers, Mr. Hurley maintained, are doing good work, and if conducted in a spirit of mutual helpfulness, with the machinery of the government standing by subject to call, their work will help solve problems and remove many of the present handicaps of business.

Speaking of foreign trade, the vice-president of the Federal Trade Commission said, the American manufacturer should realize that not a smokestack has been destroyed during this war in England, Germany or Italy, and only a few in a small part of France. Unless advantage be taken of the great opportunity American manufacturers now have, ninety days after the war is over Germany, France, England and other European nations will be on their way to a position in the markets of the world even stronger than that they occupied before.

True business preparedness demands that every American manufacturer who makes a product that can be sold abroad should aim to sell from 10 to 20 per cent of his output to foreign consumers. A market which includes both foreign and domestic business stabilizes industry and insures the manufacturer, his employees and the country against the worst effects of financial and commercial depressions. With American branch banks established in South America and projected in the Far East, there is no reason why our business expansion should halt.

Pennsylvania Public Service Law Upheld

In a brief opinion rendered by the Dauphin County Court at Harrisburg, Pa., a preliminary injunction restraining the Public Service Commission from passing on the contract for street lighting between the city of Williamsport and the Lycoming Edison Company was refused. The details of the complaint were published in the issue of the ELECTRICAL WORLD for Nov. 13 on page 1069.

More important than the matter directly involved is the intimation by the court that if the case is carried further the constitutionality of the public service law, which is attacked in the petition filed by Abraham Fischer, a resident of Williamsport, will be upheld.

In replying to Mr. Fischer's contention that the section of the public service act giving the commission authority to pass on municipal contracts is unconstitutional, Judge S. J. M. McCarrell, who wrote the opinion, says that "every possible presumption is in favor of the validity of the legislation complained of," and that this phase of the question will be taken up and promptly decided when argument is made for the granting of a permanent injunction.

MISSISSIPPI SECTION TO BE EXPANDED

Central Stations of Louisiana, Alabama and Tennessee to Be Invited to Join

The seventh annual convention of the Mississippi Section of the National Electric Light Association was held Nov. 12 and 13 at Hattiesburg. The meeting was opened with an address of welcome by President Cook of the Mississippi Normal College, followed by a talk from E. W. Lloyd, president of the National Electric Light Association, who outlined the growth of that body. Mr. Lloyd emphasized the necessity of members familiarizing themselves with the Ferris bill, which, he said, is evidently unfair as now drawn up. All that the industry wants, he stated, is a bill under which a fair return on the investment may be had for a reasonable length of time. The municipal-ownership propaganda, he intimated, can be fought only by publicity, and much good can be done by employees of the central station when the proper information is placed in their hands. Mr. Lloyd suggested that the Mississippi Section be enlarged and that the Mississippi, Alabama and Louisiana central stations be united in one section.

Status of Railway and Lighting Load

E. B. Booth of Vicksburg opened the discussion upon the "reasons for the general falling off of railway and lighting business for previous months." He attributed the decrease in street-car receipts to the three following causes, named in order of their importance: (1) General depression; (2) privately owned automobiles; (3) jitneys. Mr. Booth stated that the colored population was in a measure responsible for the decrease under the first general head. Improvidence is a characteristic of this race, and so long as they have any money at all they will spend it. Under the existing conditions of the lumber and cotton markets work has been scarce with them; consequently the revenue from the negro has been at a minimum.

Messrs. I. H. McArthur and C. M. Rogers of Meridian, J. T. Moore of Atlanta and A. J. Bemis of Vicksburg also spoke on this subject.

Boiler-Room Economy

W. F. Gorenflo opened the discussion on "Boiler-Room Economy." Mr. Gorenflo stated that usually the largest single item of expense in the generation of electricity is found in the boiler room. The fault is with the operation and not with the design of boiler, and firemen should be trained to become efficient in their work. The question of fuel selection is also important. Mr. Gorenflo stated that the cheapest fuel is the most economical when properly burned. He advised all plants to have flue-gas-analysis apparatus and said some method should be had for measuring both coal and water. If it is impossible for small plants to purchase scales, he suggested that the coal be measured and average weights be ascertained. In most cases, said Mr. Gorenflo, other losses about a power plant can be seen, but those occurring in the boiler room are only felt.

Public Utility in Politics

A. J. Bemis of Vicksburg next spoke on "The Public Utility in Politics." Mr. Bemis spoke at some length on the old methods of dealing with politicians and said that the commission form of government in recent years made these methods ineffective. Men of a better quality now hold office, and they are more open to reason. Mr. Bemis believes in publicity and said the commissioners should not only be shown the status of the industry but should be impressed with the fact that it is to the city's interest to have the utilities well maintained and the service adequate. In short, the present city government,

wherever possible, should be dealt with from a business standpoint.

At the second session the general subject of inviting municipal plants to join the Mississippi association was discussed by S. M. Jones of Laurel, Mr. Ford of Jackson, C. Z. Stevens of Hattiesburg and E. W. Lloyd of Chicago. Mr. Stevens showed that the reason for the numerous municipal plants in the State is that the towns are too small to make the investment attractive to private capital. A great number of cities whose lighting plants are municipally owned have outgrown their generating equipment and would be only too glad to sell out to some of the larger operators.

Free Service

H. F. Wheeler of Hattiesburg in opening the discussion on the "policy of companies regarding free lighting and transportation to employees and their families, also to ministers, city and county officials," stated that the business of a public-service corporation is not different from that of any other merchant. Its products are expensive to manufacture and to deliver, and a public-service company should no more give free service to its employees than should a dry-goods merchant, grocer or butcher supply his employees with necessary clothes and provisions. He believed employees should receive reduced rates for their electricity and gas, but that the service should not be free. Mr. Simonds of Vicksburg brought out the fact that the terms of service to city and county are often regulated by franchise or ordinance provisions. Mr. Ford stated that the Jackson Light & Traction Company had dispensed with all free service, except that it gives passes to employees who are actually working as well as carrying firemen and policemen while in uniform free. Employees, however, pay full price for gas and electricity, and in turn, Mr. Ford said, it is the part of the company to pay salaries sufficiently high to enable the employees to live decently. If donations are to be given ministers, these should be given in cash and not in the way of free transportation or a reduction in lighting or gas service.

O. H. Simonds of Vicksburg discussed "Lightning Protection," which he said should be regarded as insurance. In the past multi-gap arresters were placed in a hit-or-miss fashion over the distribution system, the cost being, none the less, comparatively high. The manufacturers recognized the need of a cheap but efficient arrester which could be placed near each transformer, and in consequence they have brought out the compression-chamber type. Mr. Simonds said the policy of his company is to mount a compression-type arrester at each transformer installation of 20 kw. or less. If the rating is greater than 20 kw., the installation is regarded as sufficiently important to be protected by a multi-gap-type arrester. Formerly arresters were grounded with the same wire which carried the neutral of the three-wire secondary system to earth, but at present the arresters are mounted on the transformer pole and each is grounded at its base. The neutral of the three-wire secondary is grounded one span away.

J. O. Chappell of Meridian gave an outline of new-business methods used in the Meridian Light & Railway Company and touched on the advantages of special campaigns and the revenue which might be derived from flat-rate window lighting.

Election of Officers

At the executive session by special invitation W. R. Herstein of Memphis addressed the association, pointing out a number of its weaknesses and suggesting improvements. A discussion was entered into at some length relative to a utility commission bill which it is thought will be brought before the next session of the State Legislature. Efforts will be made to expand the section to take in the privately owned central stations of Louisiana, Alabama and Tennessee.

The election of officers resulted as follows: President, O. H. Simonds of Vicksburg; vice-president, S. M. Jones of Laurel; secretary and treasurer, R. H. Smith of Jackson; executive committee, R. B. Claggett of Greenville, A. B. Paterson of Meridian, W. F. Gorenflo of Gulfport, O. H. Simonds of Vicksburg, R. H. Smith of Jackson, A. H. Jones of McComb and S. M. Jones of Laurel.

The next meeting of the association will be held at Gulfport.

The Electrical World's Street-Lighting Tables for 1916

Tables showing the time for lighting and extinguishing street lamps are now ready and will be sent free to any reader addressing the ELECTRICAL WORLD, 239 West Thirty-ninth Street, New York City. These tables are prepared for the use of central stations whose street-lighting circuits are operated on one of three plans, the all-night schedule, the moonlight schedule, and the Freund system.

The tables are issued in three separate sheets—one for the northern, one for the middle and one for the southern section of the United States.

The plan of issuing the tables as three different schedules based on geographical latitude was adopted to attain greater accuracy than was previously possible with a single set of tables. As a result the figures now cover the entire area of the United States and southern Canada with a maximum error of less than ten minutes. The northern tables are correct within five minutes for the States of Maine, Vermont, New Hampshire, Massachusetts, Rhode Island, Connecticut, New York, Michigan, Wisconsin, Minnesota, the Dakotas, Montana, Wyoming, Idaho,, Oregon and Washington, and for southern Canada. The middle schedules apply with an error of less than ten minutes to all the north and middle United States lying north of the southern boundaries of Virginia, Kentucky, Missouri, Kansas, Colorado, Utah and Nevada, including the entire area of the States mentioned as well as all of California north of Monterey. The southern schedules apply to the States of North Carolina, South Carolina, Georgia, Florida, Alabama, Tennessee, Mississippi, Louisiana, Arkansas, Oklahoma, Texas, New Mexico, Arizona and that section of California south of Monterey.

On each sheet the clock time for lighting or extinguishing the lamp is arranged in three tables according to whether the local central-station manager operates his street-lighting circuits on the all-night system (Table No. 1), the moonlight system (Table No. 2), or the Freund system (Table No. 3).

The data in Table No. 1 have been compiled in such a manner that by following this schedule the lamps are lighted one-half hour after sunset and are extinguished one hour before sunrise, giving a yearly operation of about 3830 hours. An "all-night" lighting schedule, giving a yearly total of about 4000 hours, could be obtained by lighting fifteen minutes earlier and extinguishing fifteen minutes later than shown in this table. In the so-called "Philadelphia moonlight schedule" (Table No. 2), beginning the fourth night after new moon, advantage is taken of the moonlight, and on nights when the moon is full or nearly so the lamps are not lighted. On other moonlight nights the lamps are extinguished one hour after moonrise and lighted one hour before moonset. With this schedule the lamps are in operation about 2000 hours per year. Table No. 3 is calculated according to the system of Mr. Freund and ignores the moon until after midnight throughout the year. The lighting hours after midnight are the same as those in Table No. 2. This schedule entails the use of lamps about 3000 hours a year.

BUILDINGS OF THE BUREAU OF STANDARDS, NEAR ROCK CREEK PARK, WASHINGTON, D. C.

The Development of the Bureau of Standards

By Frederic Nicholas

THERE is a general awakening throughout our industries as to the importance of utilizing scientific methods, not only with relation to measurements but in investigation work, for the purpose of improving processes and securing a better knowledge of the properties of materials upon which their useful qualities depend. To this end the Bureau of Standards contributes far more than is generally supposed. It is in constant touch with practically every branch of American industry, through correspondence, personal visits to the bureau by individual representatives, and the study of industrial processes at the factory by the bureau's experts. In this—probably its most important work—the bureau is having the hearty and sincere co-operation of technical societies, industrial concerns and scientific laboratories.— *Statement to the ELECTRICAL WORLD by Dr. S. W. Stratton, director of the Bureau of Standards.*

Interest in the work of the Bureau of Standards at Washington has been greatly increased because of the extension of the work of the bureau to include the development of standards of practice for the electrical industry. From the first, however, the electrical division has been one of the chief branches of the bureau. The bureau has met the need for electrical standards of measurement, relieving this country of dependence upon European laboratories and thus strengthening the foundations of electrical development. Present conditions outside the electrical industry, but influencing its development on broad lines, make a résumé of the organization and scope of its work of timely interest.

In 1900 Dr. S. W. Stratton, who was then a professor of physics at the University of Chicago, stopped over in Washington for a visit while on his way to Europe. During his stay in Washington he was asked by Lyman J. Gage, Secretary of the Treasury, to outline a plan for the enlargement and development of the work then done in a small way in connection with weights and measures. This study led to the introduction of a bill in Congress providing that the Office of Standard Weights and Measures should be taken out of the Coast and Geodetic Survey and become a separate bureau, known as the National Bureau of Standards. The late introduction of the bill prevented its passage at that session of Congress, but the principle then recommended was enacted into a law on March 3, 1901. Of the original organization of fourteen people, Dr. Stratton, who has been the director continuously, and several others still remain, although the present personnel is in excess of 400. This illustrates the non-political character of the bureau and the recognition of this quality by succeeding administrations at the national capital.

In the legislative steps which preceded the formation of the bureau the electrical industry took a larger part than any other single industrial interest, although none of those that were affected failed to give their hearty support. The plan was conceived at a juncture when electric central stations and manufacturers were seriously concerned over questions of standards, and leading societies and individuals welcomed the opportunity to strengthen American independence of European governmental standardizing institutions. To show the public need of the bureau, universities, faculties, pro-

fessors, societies, individuals, associations and manufacturers testified in person and by letter before committees of the Senate and the House of Representatives. The American Institute of Electrical Engineers acted through a special committee, of which W. D. Weaver was chairman and the following were members: Prof. R. A. Fessenden, Elihu Thomson, Gano Dunn and J. W. Lieb.

As the president of the Association of Edison Illuminating Companies, Mr. Lieb made an oral argument. Dr. A. E. Kennelly, then president of the A. I. E. E., testified: "You cannot create an establishment which shall declare what is the true measure of anything without creating at the same time the means of settling the numerous questions which come up in connection with such standards and establishing thereby a focus of knowledge and intelligence. That knowledge and intelligence you cannot measure in dollars and cents, but it is nevertheless a great power to the nation in the distribution of its labor and its wealth."

Among others who strongly urged action by Congress were George Westinghouse, Dr. Henry S. Pritchett, Prof. Carl Hering, John W. Howell, C. O. Mailloux, W. S. Menden, James G. Biddle and Elmer G. Willyoung. It is not strange that, with these relations at the inception of its work, the bureau has always developed and extended activities affecting the electrical industries.

Progress to Standards of Practice

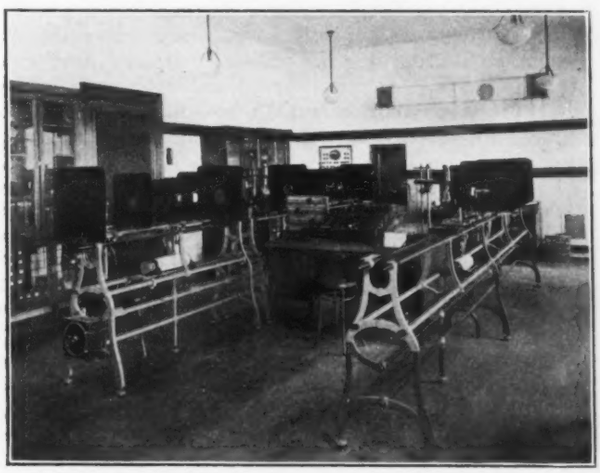
The act creating the bureau comprehensively states that the functions should "consist in the custody of the standards; the comparison of the standards used in scientific investigations, engineering, manufacturing, commerce and educational institutions with the standards adopted or recognized by the government; the construction, when necessary, of standards, their multiples and subdivisions; the testing and calibration of standard measuring apparatus; the solution of problems which arise in connection with standards; the determination of physical constants and the properties of materials." In the intervening years the fundamental ideas directing the work of the bureau have not been changed, but with time and experience they have gained in precision and breadth.

Thus the latest development is toward standards of practice, the most difficult of all to formulate and establish. These follow logically the earlier attainments in standards of measurement, standard values of constants, standards of quality, and standards of mechanical performance. Dr. Stratton emphasizes the fact that standards of practice, as well as standards of performance, are dependent upon standards of both measurement and quality. The bureau desires to take up only the leading features in such a field, confining its activities to aspects where nation-wide uniformity is wanted and leaving other matters to private laboratories.

Scheme of Organization

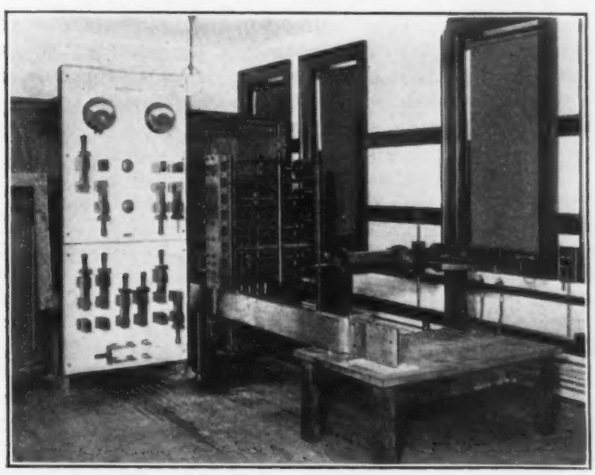
Nothing better illustrates the thorough preparation for the work evolved in different directions than a condensation of the scheme of organization as follows:

Division I. Electricity: Resistance and electromo-

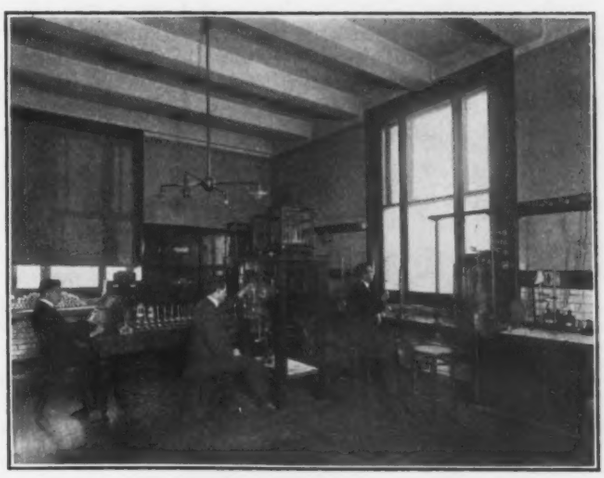


CANDLE-POWER TEST OF INCANDESCENT LAMPS

RACKS FOR CONDUCTING LIFE TESTS OF LAMPS



EQUIPMENT FOR MEASURING VERY LARGE CURRENTS



HYDROMETER-TESTING LABORATORY AT THE BUREAU

tive force, absolute electrical measurements, etc.; electrical measuring instruments, etc.; magnetism, photometry, high potential, electrolysis, radia research and public utilities.

Division II. Weights and measures: Length, mass, capacity and density, pressure, time, railroad scales.

Division III. Heat and thermometry: Thermometry, pyrometry, calorimetry, special problems, fire-resisting properties.

Division IV. Light and optical instruments: Spectrometry, polarimetry, radiometry, interferometry.

Division V. Chemistry: Chemical investigations, standard reagents, ores and metals, chemical analysis and material testing, structural materials (except iron and steel), and miscellaneous materials.

Division VI. Engineering instruments: Engineering instruments and engineering investigations.

Division VII. Engineering, structural and miscellaneous materials: Metals, cement, concrete, stone, gravel and sand, ceramics and glass, lime, rubber, paper, textiles, etc.

Division VIII. Metallurgical and metallographic: Metallurgical and metallographic investigations.

Operation of plant: Power plant, refrigeration, storage battery, buildings and grounds, and delivery.

Construction: Instrument shop, woodworking shop, glass-blowing shop, plumbing and piping, wiring and electric work, optical shop and photographic shop.

Office: Storeroom, library, mails and files, accounts and personnel, correspondence.

Starting in 1901 with temporary offices in scattered buildings in the down-town district, the bureau began a plan of building which it has followed consistently. To be free from electrical and mechanical disturbances, a building site was selected in the northwest part of Washington. Eight acres of land were bought, and by later purchases the tract has been doubled. The mechanical plant and physical laboratory, the first buildings in the group of structures laid down in the comprehensive original design, were occupied late in 1904. At about the same time the construction of a low-temperature laboratory was begun. Another laboratory was completed in 1910. The electrical laboratory was finished in 1913. There are also six smaller buildings for special purposes. A chemical laboratory is now under construction. The next large building desired is one for the testing of heavy structural materials, to consolidate work now divided between Washington and the branch laboratory at Pittsburgh. Preliminary studies for this are now under way, following the practice of the bureau to undertake no new construction until the main essentials have been worked out thoroughly in advance. A radio laboratory has also been requested to promote study. At present the Navy Department and the Army Department occupy rooms in the laboratories of the bureau in connection with their radio work, while the studies of the bureau in this direction require rooms in the electrical laboratory.

Standards Not Mandatory

In the history of the bureau substantially no mandatory standards have been established. Congress, which has power under the constitution "to fix the standard of weights and measures," did not establish any compulsory standard for general commercial use until its last session. The act establishing a standard barrel for fruits, vegetables and other dry commodities and subdivisions thereof, and also a standard barrel for cranberries, was approved on March 4, 1915. Authority is given to the bureau to establish tolerances and rules and regulations governing this law. In practically all respects the work of the bureau is advisory. The close contact of its representatives with national associations in the electrical industry is well understood. Equally close relations are maintained with the technical associations in other industries. The bureau relies upon co-operation with the industries to obtain results. Its methods are illustrated in the annual conferences on weights and measures, the tenth of which was held last May and was attended by representatives of states and cities. A conference on the testing of textiles is to be held in December which it is hoped will be the first of a series of annual meetings. A similar series is proposed in connection with the National Electrical Safety Code. There are many such conferences during the year which bring the bureau into close contact with the interests it was intended to serve.

In conformity with the government system, the expenditures of the bureau include the outlays on permanent structures. The four existing large laboratories and the chemical building under construction represent each an outlay of about $200,000, or a total of $1,000,000. This is interesting in comparison with the proposed expenditure of $5,000,000 by the Navy Department for a laboratory for the use of the Naval Advisory Board alone. The plan suggested is that the Bureau of Standards shall remain as the great research laboratory for all departments of the government, and that the proposed Naval Advisory Board laboratory shall take up questions dealing with the manufacture of apparatus.

As expenditures of the bureau are partly for permanent improvements, the fluctuations from year to year are misleading. In the current year, ending June 30, 1916, the appropriations allowed amounted to $734,780. For the ensuing fiscal year the bureau has asked for appropriations for new work on standard materials, textiles, color standards, clay products, testing machines, site and building for testing laboratory, promotion of export trade, physical constants, standardization of mechanical appliances, and for a radio laboratory.

Testing of Materials

One of the principal activities of the bureau is the testing of materials for the government. It has tested the materials entering into the construction of the Panama Canal and does work of the same kind for practically every branch of the government service. For this work it is not allowed, under the law, to make any charge, although the estimated value of it in the fiscal year ended June 30, 1915, based upon the charges to the public for similar investigation, amounted to $140,295, representing 105,992 tests. In addition, the bureau inspected 1,861,439 incandescent lamps at various factories for departments of the government, the fees for which would be $5,546. For the public there were 10,212 tests during the same year, for which fees of $14,438 were charged. The testing for the public is confined almost exclusively to standards of measurement as the bureau does not compete with private testing laboratories in the commercial testing of materials.

Promotion of Employees

The rapid development of the bureau and growth in the number of its personnel have been accompanied by a systematic policy governing promotions of the younger employees. In the scientific divisions nothing but lack of ability and available positions at higher salaries stands in the way of advancement of even the laboratory apprentices, who start with the statutory salaries of $480 a year. Beginning as graduates of the high school, they are encouraged to take the evening courses of study which are available in Washington and are made easier for them by reason of the short government office hours. With from three to five or six years of successful night-school work and the laboratory training which their labors in the bureau give, they are

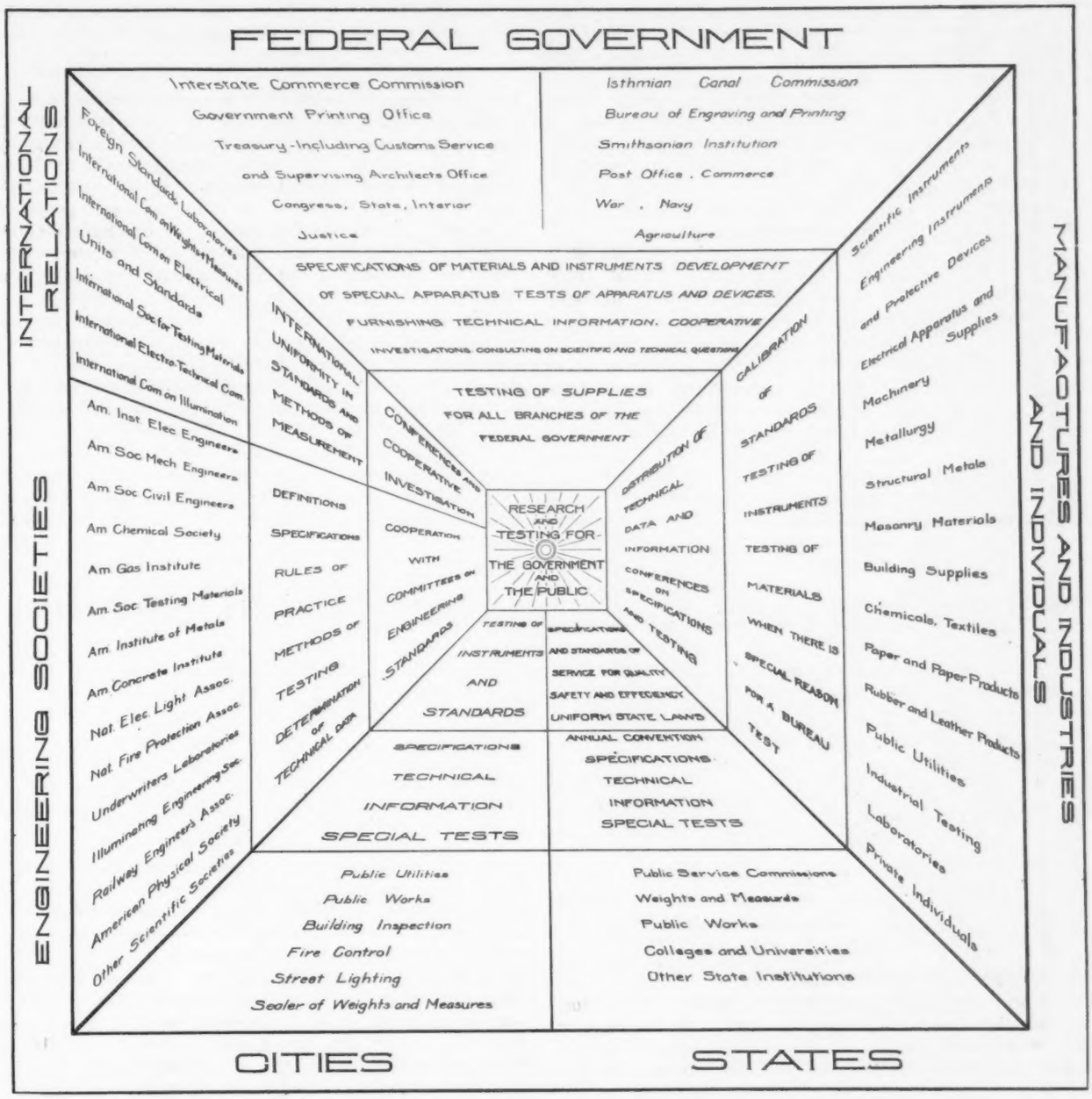


CHART SHOWING THE WORK OF THE BUREAU FOR THE GOVERNMENT AND FOR THE PUBLIC

regarded as being equivalent to college graduates, and if their work is of sufficiently high grade to justify it, are considered on equal terms with such graduates for appointment to higher positions. By similar study and work they may progress to the point where they compete with graduates of advanced university courses. Likewise, in the office division, the youngest boys are promoted to a certain higher rank if they learn stenography and typewriting. In some divisions every employee, even to the junior apprentice, is given a personal interest in or complete charge of an individual piece of research work. This tests and increases his research ability and is one of the factors that have developed the *esprit de corps* which prevails throughout the organization.

While much of the apparatus in the bureau has been purchased, either in this country or abroad, a great deal of equipment has necessarily been invented by the staffs of the different divisions to meet the particular requirements of investigation work. Although necessarily some of the work for the government departments is confidential, systematic publicity is given to the results of the general research investigations. This is done through correspondence with interested parties and by means of publications. In addition to the lists of commercial organizations to which the publications are sent, about 500 libraries receive them and keep them for reference purposes. They are revised from time to time to include the latest knowledge available. Mostly they are on scientific and technologic subjects, but a recent one is on "Household Measures." This will be followed by several which have to do with matters of general public interest.

Work for Manufacturers

Much of the work of the bureau promotes the interests of manufacturers, indirectly or directly, but some furthers specific ends which gain added importance from the European war. For instance, requests are received for governmental certificates of the quality of goods sent to South American buyers. Such certifications are common in Europe, and the enlargement of the bureau

functions and staff to provide equal facilities for American manufacturers will be a substantial aid to exporters. Another illustration is found in the dependence of this country upon Europe for the supply of glass used in the manufacture of all kinds of optical goods, which has led to the installation of apparatus and furnaces for the study of the manufacture of optical glass. The bureau is working in close touch with the clay-products industries, having shown recently that a combination of American clays is not only equal but superior to the imported clay heretofore considered essential in the manufacture of retorts, glass pots, crucibles and other refractories. There is a decided tendency on the part of the metal, cement, paper, textile, rubber, paint and many other industries to co-operate with the bureau in establishing standards of quality by which such materials may be measured and, what is of even greater importance, to find out the fundamental facts upon which the properties of such materials depend. In their contact with the bureau the representatives of these industries are brought face to face with the value and necessity for research work. As a result the bureau has become a most important factor in the application of science and the development of research on the part of the industries. It is supplementing other constructive work of the Department of Commerce.

Ranks with Foreign Governmental Laboratories

The Bureau of Standards was intended to be a national physical laboratory, serving for this country as the laboratories of England, France and Germany act for those nations. In the arguments advanced before Congress during the consideration of the original bill particular attention was called to the need of an institution corresponding to those of European countries. The bureau has been so developed that it ranks with the older European laboratories and in some directions it surpasses them. It has gone farther than they have in the establishment of working relations with the private industries and in encouraging in commercial organizations a spirit of investigation and striving for scientific attainments. Thus this country is equipped as effectively as England, with its National Physical Laboratory and the Standards Department of the Board of Trade; as France, with its Laboratoire d'Essais, and as Germany, with its Normal-Eichungs Kommission, Physikalisch-Technische Reichsanstalt, and Materialprufungsamt.

Steady Increases in Light and Power Operations

September Central-Station Earnings and Output Show Largest Gains for Any Monthly Period Since the Beginning of the European War

EARNINGS and output of the light and power companies for the month of September were well ahead of those for the previous September, according to the returns received by the ELECTRICAL WORLD. The increase in gross earnings was 8.5 per cent, and that in kilowatt-hours output 15 per cent. This percentage growth in income is the largest that has been registered for some time, while the percentage of increase in output is larger than any in the previous eighteen months.

With the exception of the New England States, where a slight reaction seems to have set in from the extraordinarily large loads which the companies in that territory have been carrying of late, the results of the September operation show larger percentage increases than at any other time since the beginning of the calendar year. Labor difficulties in September, however, in New England caused for a short time diminished production in some lines. The jitney invasion was in full swing, and in many parts of New England, especially in Rhode Island, made inroads on urban railway transportation which, of course, acted directly to cut down the load supplied to these railways by central stations.

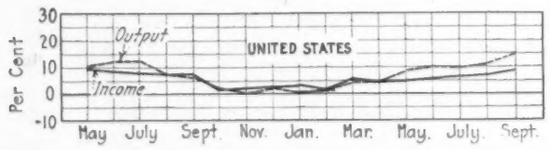


FIG. 1—CENTRAL-STATION INCOME AND OUTPUT GAIN BY MONTHS IN PER CENT FOR UNITED STATES

In the Atlantic States progress has been slow. The South has picked up to a large extent and, besides running again at full speed, has laid plans for large growth, particularly in the manufacture of cotton goods.

The Central States, which before the war reported the greatest gains in earnings and output, are again showing similar percentages of growth. All reports from this region indicate prosperity and a full return to pre-war conditions. In some cases even greater activity is noted. So phenomenal has been the increase in demand for zinc that central stations in the zinc-mining region have in almost every case found it necessary to install additional equipment to take care of the increased load. The large harvest and the movement of the grain have also helped to restore the prosperity of the Middle West.

TABLE I—CENTRAL-STATION RETURNS FOR TWELVE-MONTH PERIOD

	Percentage of Industry Represented	Income from the Sale of Energy			Kw.-Hr. Output		
		1914	1913	Per Cent Increase	1914	1913	Per Cent Increase
1914							
Oct..	59	$17,667,912	$17,174,567	2.8	$969,817,024	$935,249,519	3.0
Nov..	65	19,777,650	19,260,451	2.7	986,456,324	978,934,946	0.8
Dec..	65	20,978,430	20,281,812	3.3	1,074,083,543	1,043,457,795	3.0
		1915	1914		1915	1914	
Jan..	65	21,582,547	20,697,423	4.1	980,085,036	966,200,323	1.4
Feb..	63	19,395,518	19,023,107	2.0	853,817,221	835,288,039	2.2
Mar..	64	18,654,443	17,529,054	6.4	939,117,179	896,903,968	4.8
April.	65	18,406,412	17,675,784	4.2	900,536,022	859,235,144	4.8
May.	65	17,644,205	16,764,546	5.3	920,895,324	842,386,583	9.3
June.	65	17,595,062	16,469,009	6.9	924,688,923	836,040,113	10.6
July..	64	18,479,980	17,192,888	7.5	971,351,989	880,373,129	10.4
Aug..	64	17,284,278	15,971,080	8.2	948,569,574	850,508,473	11.3
Sept..	63	18,174,020	16,742,371	8.5	984,282,225	856,277,368	15.0

In the Far West the September figures show the largest increases in per cent of any month since these data were first collected. The lumber industry of the Northwest, feeling the renewed building activity in different parts of the country, has resumed operations on a large scale. In the southern region the expositions were responsible to a certain degree for better conditions.

Industrial Load Increase

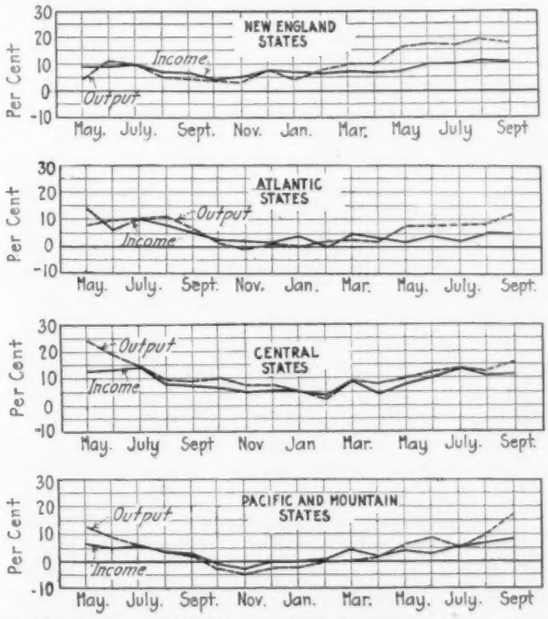
The large figures of increase in output would indicate, as is borne out by the reports, that most of the increase

TABLE II—CENTRAL-STATION RETURNS BY SECTIONS OVER A TWELVE-MONTH PERIOD

	Month	New England States				Atlantic States				Central States (Illinois Excluded)				Pacific and Mountain States		
		Percentage of Industry Represented	1914	1913	Per Cent Increase	Percentage of Industry Represented	1914	1913	Per Cent Increase	Percentage of Industry Represented	1914	1913	Per Cent Increase	Percentage of Industry Represented	1914	1913	Per Cent Increase
INCOME	Oct.	64	$1,963,579	$1,889,255	4.0	67	$7,451,220	$7,232,063	3.1	57	$5,105,810	$4,783,847	6.8	85	$3,146,160	$3,157,689	0.3*
	Nov.	67	2,229,742	2,115,957	5.6	69	8,373,772	8,157,966	2.7	57	5,408,672	5,158,981	4 8	88	3,503,499	3,574,086	2.0*
	Dec.	67	2,385,711	2,218,387	7.5	69	8,765,275	8,894,773	2.2	57	5,992,542	5,654,740	5.9	88	3,834,902	3,813,912	0.3
			1915	1914			1915	1914			1915	1914			1915	1914	
	Jan.	67	2,423,795	2,271,881	6.8	69	9,075,335	8,695,593	4.4	57	5,827,997	5,525,579	5.4	88	3,960,608	3,917,371	1.0
	Feb.	67	2,246,794	2,134,341	5.4	69	8,037,878	7,968,625	0.9	55	5,296,786	5,148.439	3.0	85	3,576,432	3,534,864	1.2
	March	67	2,146,032	1,999,326	7.5	69	7,777,126	7,419,808	5.2	55	4,885,384	4,465,728	9.5	88	3,605,893	3,412,842	5.8
	April	67	2,109,767	1,976,473	6.8	69	7,510,810	7,241,164	3.9	57	5,003,673	4,773,949	4.8	88	3,475,740	3,366,830	3.2
	May	67	2,035,680	1,887,606	7.9	69	7,100,334	6,912,581	2.6	57	4,946,907	4,577,818	8.1	88	3,383,749	3,233,989	4.8
	June	67	2,063,423	1,874,575	10.2	69	6,945,986	6,628,523	4.8	57	4,984,858	4,485,165	11.2	88	3,409,738	3,281,696	3.9
	July	66	2,020,513	1,835,968	10.2	68	6,710,217	6,519,442	2.9	56	4,792,886	4,203,702	13.9	88	3,539,168	3,317,713	6.8
	August	63	2,006,676	1,809,722	11.0	68	6,853,118	6,511,307	5.3	56	4,741,523	4,232,927	12.2	88	3,545,454	3,288,729	7.8
	September	62	2,078,013	1,880,515	10.5	68	72,888,42	6,904,245	5.5	55	5,005,472	4,437,314	12.9	87	3,655,002	3,378,746	8.2
KW.-HR. OUTPUT	Oct.	64	67,520,070	65,068,938	3.8	67	358,458,539	351,362,247	2.1	57	295,490,712	266,827,567	10.5	85	245,966,868	252,047,828	2.4*
	Nov.	67	69,480,163	66,988,456	3.8	69	361,364,405	364,155,750	0.7*	57	290,681,750	269,220,528	8.0	88	255,651,947	269,467,354	5.1*
	Dec.	67	78,510,793	71,990,132	7.8	69	401,623,514	396,251,867	1.2	57	315,027,232	291,511,670	8.0	88	278,922,004	283,704,076	1.6*
			1915	1914			1915	1914			1915	1914			1915	1914	
	Jan.	67	72,550,608	69,317,803	4.7	69	374,972,536	373,336,906	0.7	57	272,623,760	258,572,903	5.5	88	252,531,483	256,198,272	1.4*
	Feb.	67	66,600,132	61,515,979	8.3	69	312,443,505	305,307,260	2.4	55	238,938,034	232,520,476	2.7	85	229,865,568	229,185,967	0.3
	March	67	72,121,319	65,343,335	10.5	69	346,341,496	335,506,429	3.3	55	257,136,231	235,656,647	9.2	88	255,529,704	253,423,951	1 0
	April	67	68,475,232	62,442,110	9.7	69	320,142,323	311,476,008	3.0	57	257,967,434	237,673,326	8.5	88	246,287,781	239,661,364	2.8
	May	67	68,823,914	61,060,621	12.9	69	326,191,569	301,440,779	8.1	57	262,885,043	236,154,464	11.2	88	254,586,394	236,062,868	7.8
	June	67	71,566,127	60,972,379	17.4	69	318,245,370	293,751,083	8.5	57	265,551,926	234,034,477	13.2	88	261,083,835	237,843,021	9.8
	July	66	71,025,184	60,755,381	17.0	68	320,371,761	293,909,832	9.0	56	264,151,924	232,146,227	13.9	88	274,488,334	258,475,004	6.3
	August	63	69,169,042	58,440,993	18.5	68	329,947,721	302,960,234	8.9	56	269,326,039	237,550,530	13.4	88	276,631,551	248,463,980	11.3
	September	62	71,342,456	60,819,085	17.2	68	358,765,971	319,549,780	12.3	55	271,262,000	234,810,441	15.3	87	278,933,924	237,633,240	17.5

is due to a greater industrial load. When industrial activity was at its low point the opportunity was taken to install electrical equipment. The difference between the percentage increase in output and the percentage increase in income is not due entirely to an increased motor load, however. Since September, 1914, there have been many substantial reductions in rates for energy in every section of the country. Such reductions, of course, were not without their advantages, but it is uncertain how much new business can be attributed to this cause. There has been in the past year a further reduction in income from lighting brought about by the more extended use of lamps of a lower specific consumption. This has been particularly noticeable in the statements of companies which have not been active in new-business getting.

It will be remembered, however, that the September,



FIGS. 2 TO 5—CENTRAL-STATION INCOME AND OUTPUT GAIN BY MONTHS IN PER CENT SECTIONALLY

TABLE III—PERCENTAGE RATE OF INCREASE IN INCOME AND KILOWATT-HOUR OUTPUT FOR UNITED STATES—CITIES GROUPED ACCORDING TO SIZE

	Jan.	Feb.	March	April	May	June	July	Aug.	Sept.
INCOME:									
Group 1....	2.7	2.0	8.0	3.8	4.8	6.5	5.3	7.2	7.3
Group 2....	8.8	3.7	6.9	5.0	6.2	2.8	8.8	9.1	10.0
Group 3....	2.4	2.5	5.2	5.5	5.8	10.1	9.7	14.5	15.4
Group 4....	5.8	6.8	5.0	3.9	7.1	6.9	8.2	8.0	9.0
Group 5....	4.5	0.9	1.6*	1.9	5.5	4.7	8.5	7.5	11.9
OUTPUT:									
Group 1....	3.9	2.8	5.7	5.4	7.2	10.1	11.1	9.7	12.2
Group 2....	4.3	5.7	7.9	11.2	13.1	9.1	18.1	19.0	18.9
Group 3....	1.2	3.9*	3.6*	1.2*	6.1	11.2	4.5	13.0	24.0
Group 4....	9.0	5.5	3.2	3.0	29.1	6.0	12.5	10.9	11.3
Group 5....	7.5	15.0	7.0	5.9	15.5	14.8	20.5	12.7	19.3

TABLE IV—PERCENTAGE RATE OF INCREASE IN INCOME AND KILOWATT-HOUR OUTPUT FOR NEW ENGLAND STATES—CITIES GROUPED ACCORDING TO SIZE

	Jan.	Feb.	March	April	May	June	July	Aug.	Sept.
INCOME:									
Group 1....	7.1	5.7	6.6	6.3	9.4	11.6	11.2	11.0	10.6
Group 2....	6.2	4.1	9.0	4.04	7.5	7.0	7.0	9.6	10.3
Group 3....	7.5	0.7	7.8	20.6	8.9	21.8	10.2	16.5	14.7
Group 4....	8.9	9.4	6.5	8.4	7.1	11.9	6.6	7.8	9.8
Group 5....	2.1*	1.9	14.7*	0.4*	1.0*	2.8	16.0	21.2	5.8
OUTPUT:									
Group 1....	6.3	11.1	12.0	12.7	16.0	19.0	17.2	17.2	19.2
Group 2....	5.4	6.4	12.3	12.3	19.9	20.8	26.0	26.0	21.7
Group 3....	1.2	3.6*	0.3*	3.2	7.0	17.9	13.5	12.3	14.4
Group 4....	10.9*	9.4	12.5	12.1	6.3	17.1	7.8	13.8	9.4
Group 5....	9.0*	6.1	29.8*	25.5*	13.5*	1.0	11.0	15.1	8.5

TABLE V—PERCENTAGE RATE OF INCREASE IN INCOME AND KILOWATT-HOUR OUTPUT FOR ATLANTIC STATES—CITIES GROUPED ACCORDING TO SIZE

	Jan.	Feb.	March	April	May	June	July	Aug.	Sept.
INCOME:									
Group 1....	1.3	1.3	4.7	1.6	2.0	3.8	1.4	4.0	4.4
Group 2....	5.0	4.2	7.1	5.6	8.2	8.0	9.7	11.6	11.0
Group 3....	3.3	3.6	3.8	4.1	1.6	7.5	7.5	8.5	8.9
Group 4....	4.9	10.1	6.8	2.9	6.2	3.9	7.0	8.4	10.0
Group 5....	9.0	†	†	15.2	19.6	14.8	†	2.0*	14.3
OUTPUT:									
Group 1....	1.7	3.0	6.1	4.8	9.0	8.2	8.0	9.0	11.6
Group 2....	3.1	7.0	9.7	7.6	7.1	11.0	17.0	15.0	16.3
Group 3....	7.4	2.7*	8.5*	4.1*	3.2	7.2	7.5	6.4	10.4
Group 4....	7.8	6.3	10.2	1.9	22.5	7.1	13.8	13.2	12.5
Group 5....	13.5	†	†	57.2	71.5	61.8	†	11.4	13.8

*Decrease †Results omitted owing to insufficient returns.

TABLE VI—PERCENTAGE RATE OF INCREASE IN INCOME AND KILOWATT-HOUR OUTPUT FOR CENTRAL STATES—CITIES GROUPED ACCORDING TO SIZE

	Jan.	Feb.	March	April	May	June	July	Aug.	Sept.
INCOME:									
Group 1....	6.1	3.5	10.1	7.3	9.8	11.4	11.8	12.2	12.4
Group 2....	4.3	1.4	5.9	3.5	3.0	5.6	7.0	7.5	8.6
Group 3....	2.1	6.2	11.3	10.4	15.5	19.6	16.4	21.0	22.0
Group 4....	3.6	6.0	8.3	6.0	6.7	12.4	13.0	16.9	17.9
Group 5....	3.7	2.8	7.7	7.6	19.9	5.0	1.2	20.2	13.5
OUTPUT:									
Group 1....	9.0	4.7	7.7	6.8	8.4	10.8	11.8	12.2	15.2
Group 2....	4.8	1.2	8.0	12.5	9.7	13.5	11.1	9.8	9.0
Group 3....	8.2	6.2	14.7	13.1	27.0	26.1	28.9	31.0	29.3
Group 4....	8.4	10.0	12.8	7.9	10.0	15.7	18.2	26.1	29.0
Group 5....	13.7	18.3	13.5	30.7	28.8	20.4	24.9	25.1	48.0

TABLE VII—PERCENTAGE RATE OF INCREASE IN INCOME AND KILOWATT HOUR OUTPUT FOR PACIFIC AND MOUNTAIN STATES—CITIES GROUPED ACCORDING TO SIZE

	Jan.	Feb.	March	April	May	June	July	Aug	Sept.
INCOME:									
Group 1....	1.0*	0.4	8.1	4.0	3.1	9.0	5.1	7.0	13.9
Group 2....	4.9	8.0	7.5	9.4	12.7	11.1	13.0	11.1	11.5
Group 3....	0.6	2.6*	1.0*	0.3*	3.4	3.6	7.9	17.1	19.7
Group 4....	6.2	0.6	2.6*	3.8*	8.7	1.6*	7.8	0.2	0.3
Group 5....	1.8	2.0*	3.5*	2.7*	2.4*	3.3	4.5	1.7*	15.0
OUTPUT:									
Group 1....	1.5	0.5*	2.5	4.5	2.3	10.8	6.2	6.3	8.4
Group 2....	7.2*	13.5	3.0	11.6	19.0	14.9	27.5	39.3	40.3
Group 3....	13.5*	11.5*	4.0*	3.5*	3.8	12.4	8.4*	18.5	49.2
Group 4....	9.5	0.6*	9.5*	4.7*	87.0	4.5*	11.8	0.2	4.1
Group 5....	4.1	9.9	18.0	9.6	18.5	3.6	10.9	8.0	21.0

*Decrease.

1915, figures are compared with the September, 1914, figures. While the percentage increases did not fall much in the first two months of the war, they were below the figures for the month previous to the war, and this fact must not be lost sight of in making comparisons with operations during war months.

Large Increases General

The increased percentages of growth in income and output were not confined to companies operating in cities of any particular size. They were registered by both the small and the large companies.

During the first nine months of the calendar year the gross earnings for the entire central-station industry increased by 5.7 per cent and the output by 7.7 per cent. The percentages for the same period by sections are as follows: Earnings—New England, 7.9 per cent; Atlantic States, 3.2 per cent; Central States, 9.1 per cent; Pacific and Mountain States, 4.2 per cent. Output—New England, 12.6 per cent; Atlantic States, 6.4 per cent; Central States, 10.2 per cent; Pacific and Mountain States, 6.0 per cent.

The accompanying curves show graphically the percentage increases by months that are given in Tables I and II. The remaining tables show the percentage increases by months of income and output by cities according to size. Group 1 includes those companies operating in cities having a population of over 100,000; group 2, in cities with a population between 50,000 and 100,000; group 3, between 25,000 and 50,000; group 4, between 10,000 and 25,000, and group 5, between 5000 and 10,000.

The Signaling Range in Radiotelegraphy

Measuring the Effect Which Antenna Height, Antenna Current and Wave-Length Have Upon the Distance of Transmission

BY JOHN L. HOGAN, JR.

THE several series of long-distance transmission tests carried on jointly by Dr. L. W. Austin and the National Electric Signaling Company[1] included measurements of the effect on signaling range of antenna height, antenna current and wave-length. Heights from 37 ft. to 130 ft., sending currents from 7 amp. to 30 amp. and wave-lengths from 300 meters to 3750 meters, were observed at distances up to 1000 nautical miles. Correlation of the data thus secured led to the expression

$$I_r = \frac{4.25 I_s h_1 h_2}{\lambda d} \varepsilon^{-0.0015 d/\sqrt{\lambda}} \qquad (1)$$

where I_s and I_r are sending and receiving antenna currents in amperes, h_1 and h_2 effective heights at sending and receiving antennas in kilometers, λ and d the wave-length and signaling distance in kilometers. As is easily seen, the expression may be used to compute the antenna currents or heights necessary to produce a required signal strength at any given distance under normal daylight conditions. With average 500-cycle spark senders and good crystal receivers, about 10 microamp. receiving antenna current are necessary for barely audible signals.

Later tests[2] over greater distances extended the observations to antenna heights of 450 ft., sending currents of 110 amp., and distances of 2300 nautical miles. None of the data then obtained indicated need of altering the functional relation of the several quantities given in equation (1), though it was found that with the rectifying heterodyne receiver only 5 microamp. receiving antenna current gave signals of unit audibility, even with spark transmitters.

The expression (1) above has therefore been fairly well verified by application to many instances of radio transmission. It is probably the most nearly accurate equation for computations of the sort necessary if signaling distances and intensities are to be predetermined rather than estimated. For rapid numerical work it is desirable to state the various quantities in the units which are most convenient for their measurement; for instance, if sending current is in amperes, receiving current in microamperes, antenna heights in feet, wave-lengths in meters and distance in kilometers, the equation becomes

$$I_r = \frac{392 I_s h_1 h_2}{\lambda d} \varepsilon^{-0.0474 d/\sqrt{\lambda}} \qquad (2)$$

Or if, the other units remaining as just stated, distance is expressed in nautical miles, the coefficient of I_s should be 212 and the exponential coefficient 0.0877.

Simple algebraic solution of the equation is possible for all quantities except λ and d. These cannot be determined explicitly by the common methods, since they occur both linearly and exponentially. By solving for I_r/I_s and determining a maximum by differentiation with respect to λ, it is possible to secure an expression for the optimum wave-length for a given set of transmission conditions. This is perhaps too extended an application of the original relations. A graphic method of solving

[1] "Some Quantitative Experiments in Long-Distance Radiotelegraphy," by L. W. Austin, *Bulletin* Bureau of Standards, Vol 7, No. 3, 1911, p. 315.

[2] "Quantitative Results of Recent Radiotelegraphic Tests Between Arlington, Va., and U.S.S. Salem," by John L. Hogan, Jr., ELECTRICAL WORLD, June 21, 1913, p. 1361.

for d by parameter was shown in the ELECTRICAL WORLD paper above referred to.

An ingenious logarithmic method of solving for d is the basis of a series of curves used at the United States Navy Yard, Puget Sound, Wash., and forwarded for publication by H. G. Cordes. Equation (2) is divided algebraically:

$$\frac{I_r\lambda}{212I_sh_1h_2} = \frac{\varepsilon^{-0.0877d/\sqrt{\lambda}}}{d} \qquad (3)$$

and stated in logarithmic form:

$$\log_{10}\frac{I_r}{212} + \log_{10}\frac{\lambda}{I_sh_1h_2} = \frac{-0.0877d}{\sqrt{\lambda}}\log_{10}\varepsilon - \log_{10}d \qquad (4)$$

A pair of curves for $I_r = 10\mu a$ (barely audible signals) and $I_r = 40\mu a$ ("good" signals) are plotted with ordinates $\lambda/I_sh_1h_2$ and abscissas

$$\log_{10}\frac{I_r}{212} + \log_{10}\frac{\lambda}{I_sh_1h_2}$$

For each of a number of wave-lengths (those shown are United States Navy standards) additional curves are then plotted over the same abscissas equated through expression (4) to

$$\frac{-0.0877d}{\sqrt{\lambda}}\log_{10}\varepsilon - \log_{10}d$$

and with d as ordinates. By the use of these curves it is simple to solve direct for d by the process which follows:

1. Compute $\lambda/I_sh_1h_2$.
2. Locate on left-hand ordinate scale and follow in horizontally to intersection of dashed curve for received antenna current desired.
3. From intersection proceed vertically to intersection with solid curve for assumed wave-length.
4. Proceed to right horizontally from this second intersection and read required value of d on right-hand ordinate scale.

The example $I_s = 10$ amp., $h_1 = h_2 = 115$ ft., $\lambda = 952$ m., is shown by dotted lines for $I_r = 10\mu a$ and $I_r = 40\mu a$, the signaling distances being respectively 565 miles and 305 miles.

When computing night-time signaling, or for distances less than 100 miles, the absorption term is ignored and the equation becomes

$$d = \frac{212I_sh_1h_2}{I_r\lambda} \qquad (5)$$

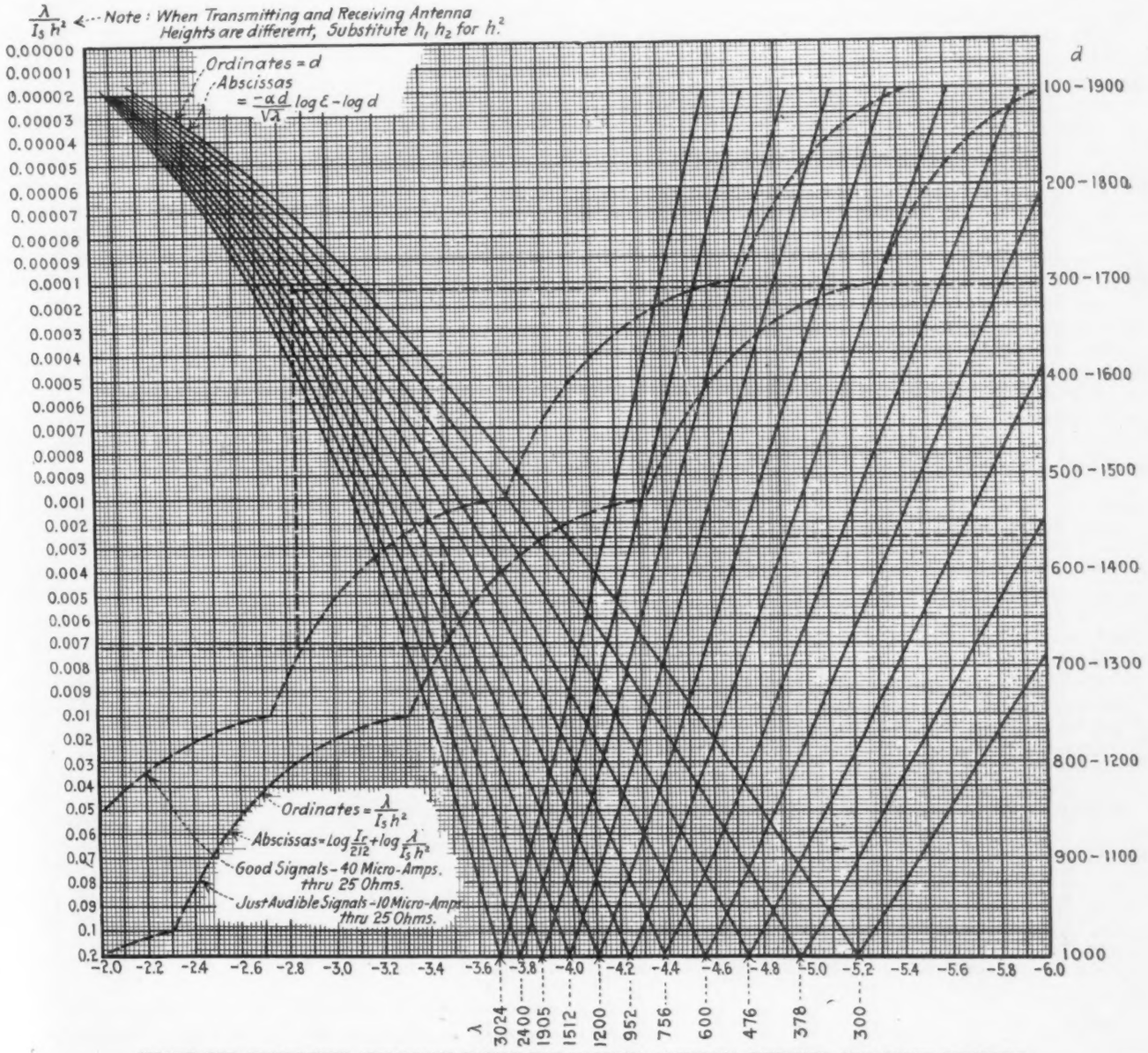


CHART FOR COMPUTING SIGNALING RANGE FOR VARIOUS ANTENNA HEIGHTS AND WAVE LENGTHS

The Electrically Propelled Battleship California

The paper abstracted below was presented by W. L. R. Emmet, consulting engineer for the General Electric Company and designer of the electric-propulsion machinery of the new United States battleship California, before the Society of Naval Architects and Marine Engineers at New York, Nov. 18. The adoption of electric drive on this great American dreadnaught—the first vessel of the kind in any navy of the world to be so propelled—resulted from a campaign of education conducted by Mr. Emmet and his associates, in which the construction of the naval collier Jupiter was an incident. The contract price for the California propelling machinery with auxiliaries is stated to have been $431,000.

THE new electrically propelled battleship California, which is being built at the New York Navy Yard, is of the largest and most powerful class which has been adopted by the United States. Her displacement is 32,000 tons and her maximum speed is to be about 22 knots, requiring about 37,000 shaft hp. The contract with the manufacturer of the electrical equipment covers two turbine-driven generating units, four propelling motors (one for each shaft), switching apparatus, cables, instruments, etc., two turbine-driven exciting units, and a complete equipment of condensing auxiliaries and ventilating blowers, all driven by motors from the exciting units.

Each of the auxiliary units is of 300-kw. rating, with a 240-volt direct-current generator geared to a high-speed, non-condensing turbine. These turbines will exhaust into the heaters, into the main turbines, or both.

The award of this contract for the California was the result of a very long campaign of study, in which the equipment of the U. S. collier Jupiter was an incident. The Jupiter has now been in commission for two years and has proved an unqualified success. The steam consumption of the main drive with 190 lb. pressure, dry steam, and 28.5 in. vacuum is 11 lb. per horsepower-hour delivered to the propeller shafts, which is at least 30 per cent better than is done by reciprocating engines in ships of the same class. There is also evidence of further saving in the Jupiter incident to the fact that her large low-speed propellers are turned with a perfectly uniform angular motion and with entire freedom from racing, conditions never heretofore achieved.

The generators for the California are bipolar alternators, and the motors are arranged to be connected for either twenty-four poles or thirty-six poles. For economic cruising at 15 knots or less one generator will be used with motors on thirty-six-pole connection. For higher speeds the twenty-four-pole connection will be used. The ship will be capable of operating at a speed of about 18.5 knots with one generator.

Speed variation with either motor connection will be effected by change of turbine speeds through the agency of variable-speed governors designed to hold automatically any desired speed within usual ranges. This arrangement, which is also used in the Jupiter, entirely prevents racing and makes it convenient to hold a fixed speed irrespective of variations in sea, weather or steam conditions. It is thought that this feature will be valuable in fleet formations.

The steam consumption guaranteed on the California covers the total steam required for the main turbines and engine-room auxiliaries as described above. The conditions are 250 lb. gage pressure, dry steam, with such vacuum as can be produced under trial conditions.

Very heavy penalties are imposed in case these guaranteed consumptions are exceeded in trials, $25,000 per pound for the two lower speeds and $20,000 per pound for the two upper speeds.

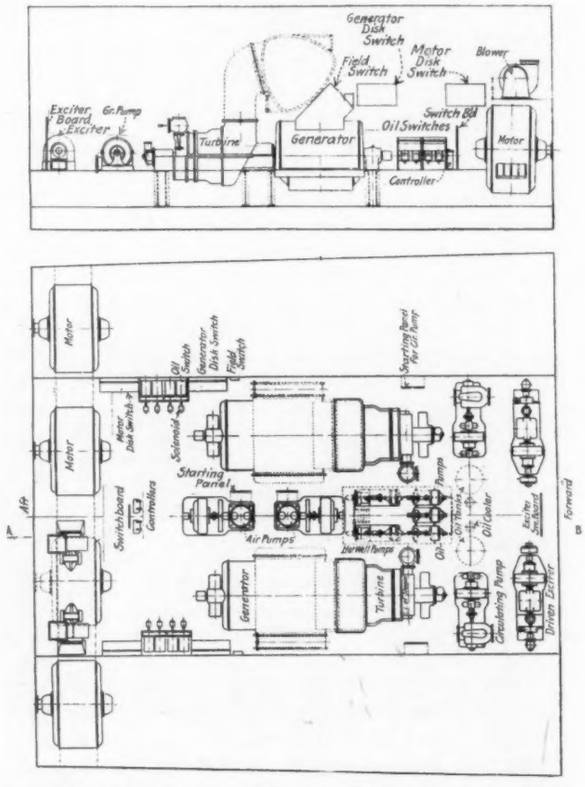
At full speed the California propellers will make 175 r.p.m., this being about the lowest speed of propellers which is practicable within the space. The propeller speeds proposed for the sister ships with Parsons turbine drive is 240 r.p.m., and comparisons by Dyson's method indicate that this speed difference will give the California an advantage of about 9 per cent in propeller efficiency.

The accompanying table gives a comparison of steam consumption per effective horsepower between the California as guaranteed, the Florida and Utah, which are driven by Parsons turbines, and the Delaware, which is driven by reciprocating engines. These figures are taken from the published records of trials.

The accompanying drawing shows the engine-room arrangement of the California suggested in the General Electric Company's proposal, although a somewhat different arrangement will actually be used.

POUNDS OF STEAM TO MAIN ENGINES PER HOUR PER ENGINE HORSEPOWER

	12 Knots	15 Knots	19 Knots	21 Knots	Proportional to Speed of 21 Knots
Florida.....	31.8	....	24.0	23.0	328
Utah.....	28.7	....	20.3	21.0	323
Delaware.....	22.0	....	18.7	21.0	122
California.....	17.3	15.2	15.0	16.4	175



PROPOSED ARRANGEMENT OF ELECTRIC PROPELLING MACHINERY OF NEW BATTLESHIP CALIFORNIA

An Underground System for an Industrial Plant

Design and Installation of Subway and Duct Lines for Distribution of Energy to Group of Factory Buildings, Together with Construction Costs

BY H. D. AUSTIN

THE electrical distribution system required by an industrial plant is not as extensive, neither is it as costly to install in proportion to the size of its generating equipment, as the distributing system required by the average town or city. This is due, of course, to the greater area which must be served by the latter system. However, the electrical distributing system which supplies a large industrial plant is often of a size sufficient to represent a considerable portion of the total cost of the industrial plant. It requires careful engineering consideration and warrants the practice of economy in its design and construction. Many problems are encountered in the design and construction of all underground subways that distribute electrical energy. Each separate system requires special treatment and usually presents many local problems which demand careful study in order to meet properly all the demands for electrical service.

In the interest of economy, the first cost must be considered. On the other hand, first cost must often be made subservient to permanency of installation, reliability and continuity of service, accessibility and rapidity with which repairs can be effected, and last, but not least, a reasonable allowance for growth.

A good subway when well built should last for a long period of years, and, in view of the difficulty experienced in rebuilding conduits and manholes that contain cables carrying electric current at high voltage, it is usually advisable to provide for in the design and use in the construction only materials that have proved permanent in service over an extended period.

In many instances the main reason for placing power-distributing lines underground is to secure reliability of service and to avoid interruptions, which in a large plant employing many men are often expensive. Therefore cheap construction might defeat the very purpose for which the subway was intended. For the same reason, it is desirable that a subway be constructed so that repairs to cables can be readily made in the shortest possible time.

As regards flexibility and the additions of extra loads from time to time as the system expands, this consideration tends further to increase the first cost of a subway system, because an extra number of spare ducts must be installed, and in most instances additional copper beyond the amount required to supply the present needs must be provided. Therefore, to secure the above most desirable features in a subway system, and at the same time effect a reasonable economy, requires engineering judgment and experience of a high degree. For this very reason subway construction is becoming a specialized branch of electrical engineering.

Design of a Subway System

In the design of a subway system probably the first thing to determine is the route which the subway will take. Since an underground cable system usually replaces existing overhead lines, and therefore the distribution centers are to a certain degree fixed, the shortest duct system that will connect all the distribution centers in the various shops and buildings with the generating station will generally be the cheapest to install. However, industrial plants are nearly always laid out on regular lines and have fixed streets or thoroughfares. Therefore it is most desirable to have the subways follow the streets wherever possible, for in this location they will be less likely to be interfered with by excavations for new building foundations. Also, extensions to subways can be readily made, and new buildings easily supplied with energy from mains, when they are in the street. Other power-distributing mains, such as steam, compressed air, hydraulic power and gas, in addition to water mains and sewers, will usually be found following the streets and below the surface at various depths. The installation of these piping systems nearly always precedes the electrical conduit, and they always provide a series of obstructions that must be encountered when installing an electrical subway system. Therefore, in routing the electrical subway, careful consideration must be given to the interferences between existing pipes, etc., and the proposed duct line. The locations of manholes and the grading of duct lines from manhole to manhole will be determined largely by the existing pipes, manholes, etc., along the street.

For the preliminary layout the writer prepares an "interference map" and a profile section of subway

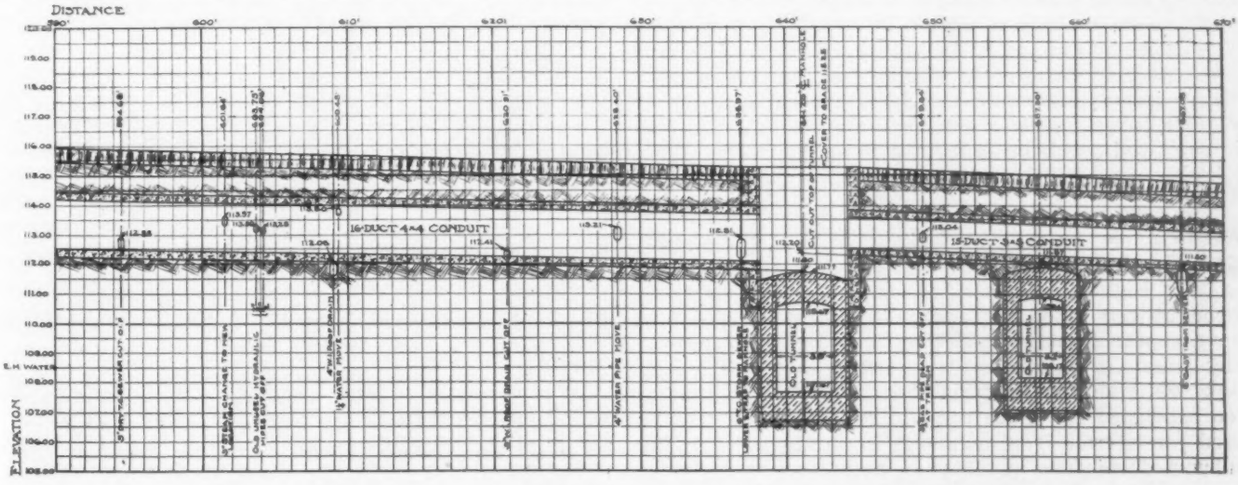


FIG. 1—LAYOUT FOR A CONDUIT SYSTEM, SHOWING HOW OBSTRUCTIONS WERE AVOIDED

showing interferences in elevation. The "interference map" is a map showing all the existing piping systems, each system being mapped in a different color. The "profile section" is a map similar to that shown in Fig. 1. The map as shown represents the obstacles encountered in running a subway through the streets of a large industrial plant. The drawing shows the conduit as

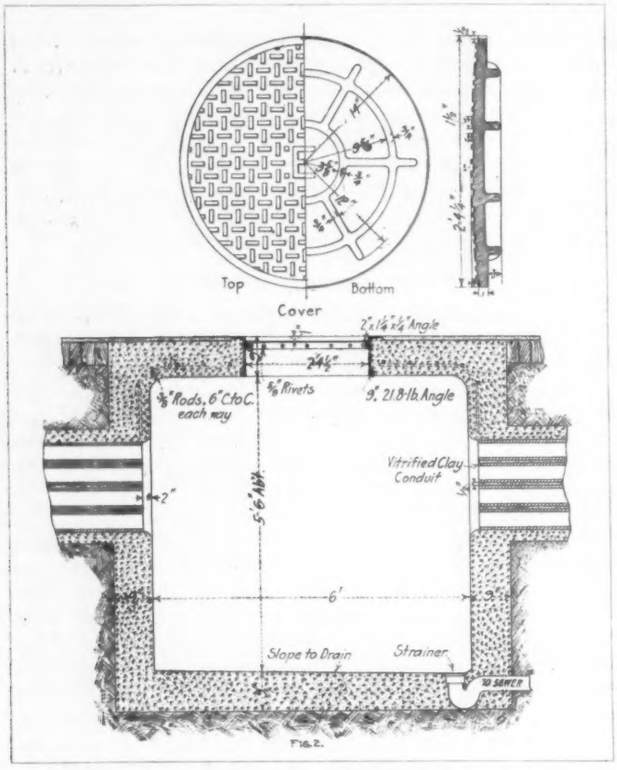


FIG. 2—MANHOLE CONSTRUCTION AFFORDING MAXIMUM CLEAR DEPTH

actually installed and illustrates how the various interfering pipes, etc., were avoided or moved. For the preliminary work a map similar to this is drawn, but, of course, many of the elevations can be only approximately determined.

In general, it is advisable to avoid as many of the existing pipes as practicable. But if the first cost of the conduit system is considerably increased by so doing, it is usually cheaper to move the interfering pipe than to try to avoid it. It is advisable to keep the subway straight from manhole to manhole, and bends in ducts to avoid obstacles should in no case be permitted. The cables pull in badly, the proper drainage of ducts is prevented, and a smooth interior duct surface is practically impossible where the ducts are laid around irregular curves unless a duct material such as iron pipe is employed and bent to form the curves.

Duct Material for Subway Construction

The next question to be settled is the best duct material to employ in subway construction. At the present time the three materials being used almost exclusively in this country are vitrified clay, fiber conduit, and wrought-iron pipe. Several newer types of conduits have appeared, but as yet they have not been used to any great extent except in certain localities. Iron pipe, while an ideal material for conduits, is in general too expensive for main conduit runs and can only be used for laterals from manholes to buildings. For the subway ducts from manhole to manhole a single duct or a multiple duct of vitrified-clay conduit containing not over three ducts is recommended. The four-duct and six-duct vitrified-clay conduit is usually not so well burned and not so straight as the shorter lengths of single duct. Single-duct vitrified clay when laid so as to break joints, with a half inch of cement mortar between ducts, and with the conduit surrounded by a 3-in. envelope of concrete, forms a conduit that is smooth inside, strong, fireproof and permanent.

Fiber conduit, which is also used to a considerable extent, possesses some very desirable features. Its first cost is low, as it can be supplied in 5-ft. lengths and laid more easily and quickly than vitrified clay. It also furnishes a perfectly smooth raceway for the cables. On the other hand, fiber conduit, as compared with the two other types mentioned, is mechanically weak and softens appreciably when exposed to a temperature of 160 deg. Fahr. It may bend and become distorted from its own weight when left in piles exposed to a hot sun. Therefore if steam pipe should break near a conduit composed of fiber ducts, it is probable that the heat would injure the conduit system. This condition, or one very similar to it, has come under the writer's observation. One of the earlier types of fiber duct, which was composed of a spiral wrapping of saturated fiber, was laid in cement mortar with a thick envelope of concrete. This conduit was in close proximity to steam and fuel-oil pipes, the surrounding ground being wet, and the conduit failed after a few years. The spiral wrappings of duct material separated, and the whole duct collapsed inwardly upon cables so that it was utterly impossible to pull the cables out of the conduit. The writer believes that steam escaping into the duct system softened the asphaltum compounds used to impregnate the conduit, and the crude oil which was present dissolved the asphaltum, leaving practically a spiral wrapping of paper, which collapsed inwardly.

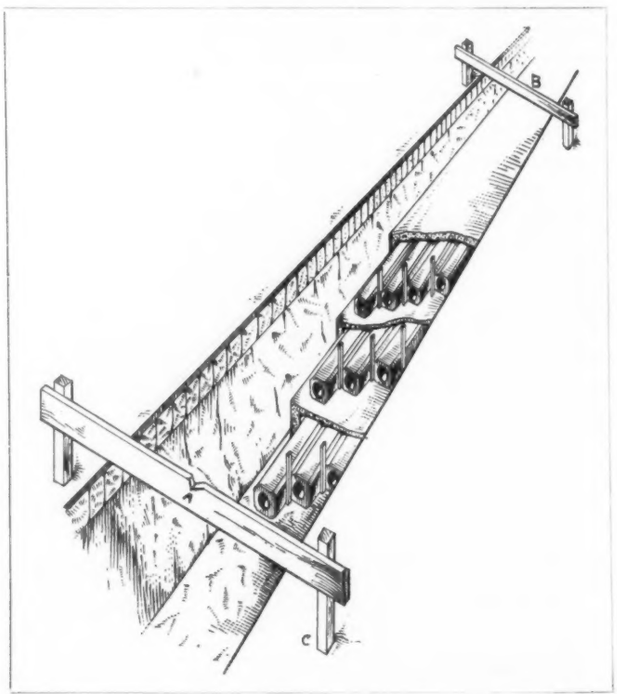


FIG. 3—METHOD OF STAKING OUT TRENCH AND GRADING FOR LAYING CONDUIT

A newer type of fiber conduit is now being made which is homogeneous in character. This duct is giving good service when installed where it is not exposed to excessive heat. The writer has made some tests on this latter fiber duct to determine if crude oil dissolves any appreciable amount of the asphaltum compounds

used to impregnate the conduit. So far these tests, which consisted in immersing sections of the conduit in crude oil for a number of months and inspecting and weighing samples at frequent intervals, have not indicated that the conduit is affected to any extent that would render it unfit for service in localities where crude oil might find its way into the ducts. Therefore,

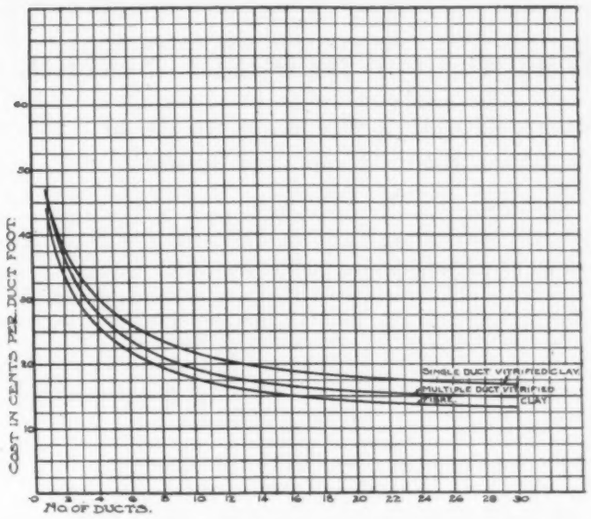


FIG. 4—ESTIMATED COSTS FOR DUCT SYSTEMS LAID THROUGH PAVED CITY STREETS

it may be said that the selection of the duct material must be determined largely by local conditions, and whether fiber or vitrified clay should be used can be decided only after careful study and investigation. In many instances vitrified-clay duct must be given the preference over fiber duct on account of the proved fact that it is both steamproof and fireproof.

Installation Features

The conduit system described in this article was laid in rather low wet land along a bay subject to tides as shown in Fig. 1. Thus the drainage of ducts and of manholes was given special consideration, and no manhole was constructed so deep that it could not be drained into one of the existing sewers. The manholes were constructed of concrete mixed in the proportions of one to two and one-half to five parts, and the top of the manhole was reinforced. Owing to the fact that few deep sewers were available for drainage, it was necessary to adopt the specially constructed frame and cover shown in Fig. 2 in order to secure the necessary clear depth inside the manhole. The frame was of the built-up type, a bulb-angle standard section being used and bent to a cylindrical form. The ends were then welded by means of the oxy-acetylene flame. A circular angle support for cover was similarly bent and riveted to the inner circle of the angle frame. The completed frames were then hot-galvanized before setting in concrete. This type of frame was found to be well suited for the purpose, and its construction was comparatively cheap since this class of work was being constantly performed in the shops which this distribution system supplies. For the duct line, single-duct vitrified-clay conduit was chosen, as this conduit when laid so as to break joints forms a strong cellular construction and can be supported over comparatively soft ground.

The method of laying this tile duct is clearly shown in Fig. 3. On either side of the proposed trench a stake was driven and a board nailed to stakes so that it was at right angles to the line of trench. The top edge of the board was then set to grade by means of a surveyor's level; that is, it was so set that the bottom of the trench to be excavated was a given number of feet below the top edge of the board. These grade boards were set 50 ft. apart, and a line *AB* (shown in Fig. 3) was then stretched from grade board to grade board. Thus, by using a measuring stick, the laborer could dig the trench to an even grade, and later the workman laying concrete and the conduit could use the same line. A slight notch was cut in the top edge of each grade board, thus locating the exact center of the trench and also the center of the conduit. This line was thus a true guide for all work in the trench.

In order to insure a straight conduit, it was absolutely necessary to lay the bottom layer of concrete so that its top surface formed an even and true grade. The first layer of tile (Fig. 3) was laid as follows:

First, a plumb line was dropped from the guide line to the concrete bottom in the trench and a center line marked along the surface of concrete by means of a line and a mason's trowel. Then the conduit was laid, using the 0.5-in. by 1-in. wooden separators shown in Fig. 3. Each joint was wrapped with cheesecloth, and after placing the concrete between the duct and the side of the trench the space between ducts was filled with a thin mortar and the wooden separators were removed. No mandrel was necessary when laying tile as above described. Further, the men who laid the tile were only intelligent laborers with a fair knowledge of concrete construction, no masons being employed. The work at all times was under close supervision, and when completed the ducts were not rodded, as they were straight and smooth enough inside to permit a small tin can or a rubber ball tied to a strong cord to be blown from manhole to manhole by using a compressed-air blast (80 lb. per sq. in.) from a ¾-in. rubber air hose. After this the ducts were cleaned and the pulling cable was drawn in.

For preliminary estimates of the cost of duct systems constructed through paved city streets the writer recommends the curves shown in Fig. 4. These curves give average cost values and show the comparative costs in cents per duct foot for constructing either single-duct vitrified-clay, multiple-duct vitrified-clay, or fiber-duct conduits laid through city streets paved with granite blocks or their equivalent.

CONSTRUCTION COSTS FOR MANHOLES AND DUCT LINE

Construction cost per manhole:	
Excavating, refilling, removal of earth and repairs to paving	$13.80
Concrete in place	45.42
Reinforcement in place	15.66
Forms in place and removal	14.02
Frame and cover	28.53
Sewer connections	15.94
Shoring, removal of obstacles and miscellaneous	9.80
Supervision	11.04
Total cost per manhole	$154.21
Construction cost per trench foot of sixteen ducts:	
Excavating, refilling and repaving	$0.708
Vitrified-clay duct	0.960
Laying ducts, concreting and cementing	0.639
Concrete and cement material	0.510
Shoring, removal of obstacles and miscellaneous	0.251
Supervision	0.310
Total	$3.378
Then $3.378 ÷ 16 = $0.211, cost per duct foot.	

The selection of cables for an underground duct system, the characteristics of various insulations, together with specifications and costs of such cables as are generally used in a subway system supplying a large industrial plant, will be considered in Part II of this article.

Station and Operating Practice

A Department Devoted to the Problems of Installation, Operation and Maintenance of Equipment for the Economical Generation and Distribution of Electrical Energy for All Uses.

Results from Better Feed Water in Wisconsin Station

Operation of Water-Treating Plant—Conditions Existing Before and After Use of Apparatus—Economies Accomplished After Two Months Under New System

BY H. G. D. NUTTING*

CONSIDERABLE trouble has been experienced by the Mineral Point (Wis.) Public Service Company in securing satisfactory boiler-feed water. The creek water and well water of the vicinity is hard, and in spite of the use of boiler compound a hard scale about 3/16 in. thick collects on the boiler tubes and shells in a run of three weeks. The effect of this scale on boiler operation and maintenance cost suggested an investigation of methods of water treatment which resulted in the installation of the apparatus shown in the accompanying illustrations.

The water-treating plant consists of two elements—a 30,000-gal. steel settling tank and a chemical proportioning and feeding device shown in Fig. 1. The settling tank is about 13½ ft. in diameter by 25 ft. in height.

The operation of the softener is automatic and requires operating attention only to provide daily a chemical mixture of lime and soda ash. The water is tested each day, the chemical orifice cleaned out, and the sludge blown off in addition.

Operating Cycle for Water-Treating Plant

The cycle of operation of the softener is as follows: When the pure-water level has dropped to a point (by feeding to the feed pumps) where the controlling float 5 causes the valve 4 in the raw-water pipe to open, the raw water discharges into the waterwheel buckets 2, causing the paddles 6 to stir the chemical solution in the upper tank and also operate the chain buckets, thus delivering the chemical solution into the constant-level cup 7. The chemical solution then flows through the fixed orifice in 7, through the pipe 11, to the down-take 12 of the settling tank. The raw water is exhausted from the waterwheel into the settling-tank down-take pipe 12, where it mixes with the chemical solution and is stirred by paddles arranged on a vertical shaft, actuated by the waterwheel through the bevel gears 13. As the water level rises in the settling tank, the float 5 rises and at a predetermined point shuts off the raw-water valve 4. This cycle of operation requires about ten minutes, during which time treated water is also being drawn from the softener to the heater through the outlet 15. The softener remains idle for about ten minutes or longer, depending upon the water required, and then starts again.

The time and number of cycles of operation are recorded by an electrical curve-drawing voltmeter contacted by the main-control float rod 5, so that, by means of a calibrated orifice, operating under a constant head controlled by a float as shown in Fig. 2, the amount of water softened is determined. By adding the amount of steam condensed in the heater, which can be accurately calculated from the record of inlet and outlet temperatures at the heater and the amount of water delivered to the heater from the softener, a record of daily water evaporated in the boilers is obtained. This quantity is corrected for the amount of water blown out of the softener with sludge, as determined by calibration of the sludge blow-off valve.

To provide the hottest water possible to the softener and secure the best economy of heat distribution

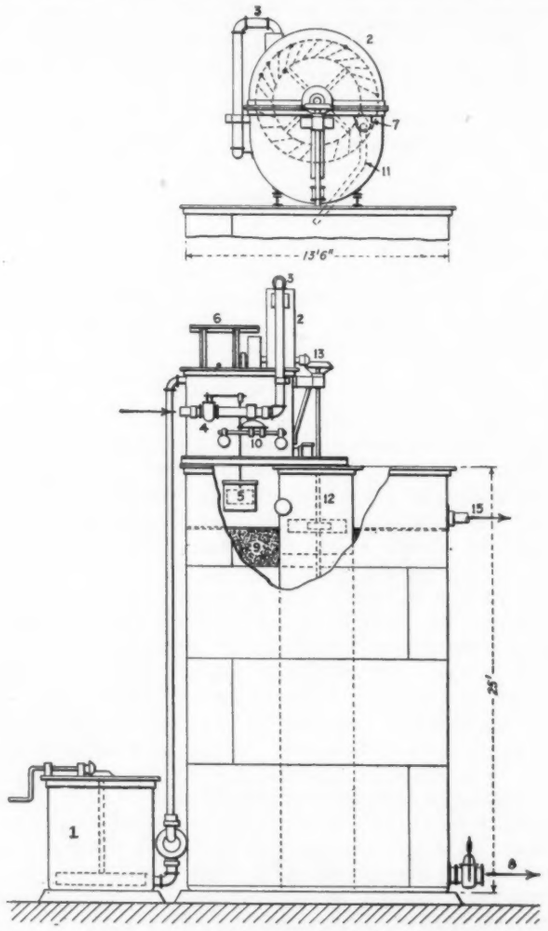


FIG. 1—SETTLING TANK, CHEMICAL PROPORTIONING AND FEEDING DEVICE OF WATER-TREATING PLANT

The mixing tank shown at 1 is installed on the ground level, provided with a hand-operated stirring paddle and a steam siphon for lifting the chemical solution to the chemical tank on top of the settling tank. The waterwheel at 2 is operated by the raw water discharged into the settling tank through the pipe 3. A raw-water control valve at 4, operated by float 5, is controlled by the water level of the treated water. The paddle wheel 6 used to stir the chemical solution in the upper chemical tank is operated by the waterwheel. The constant level cup 7 contains an orifice for feeding the chemical solution in the correct proportion to the raw water, and a bucket chain (not shown), for keeping the constant level cup full, is operated from the waterwheel. A sludge blow-off pipe is shown at 8 and a filter at 9. A raw-water-measuring device consisting of an orifice and a constant head control is indicated at 10.

*Consulting engineer, Milwaukee, Wis.

throughout the plant, the water to be treated is taken from the discharge side of the Westinghouse Le Blanc condensers without additional pumping, the discharge head being sufficient to operate the softener. This water has a temperature of from 90 deg. Fahr. to 120 deg. Fahr., depending upon the load and weather conditions. The "make-up" water, which is practically equivalent to the amount used by the turbines not including the auxiliaries, and which is comparatively cold water, is fed to the condenser injection pipe. In this way the hot water is delivered at its most advantageous point (direct to the softener) and the cold water at its most advantageous point (the condenser).

Cost of Treating Water

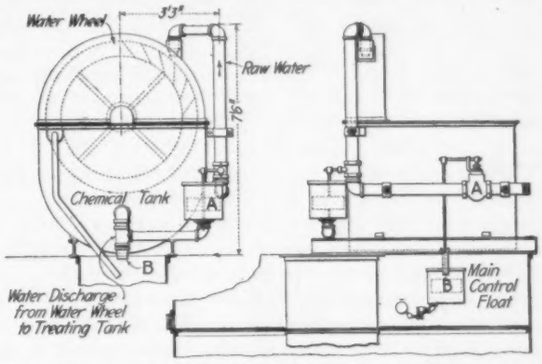
As already mentioned, the chemicals used are soda ash and hydrate of lime. The amount required per day on the average is 35 lb. of soda ash and 125 lb. of lime. This amount is sufficient to treat 65,000 gal. of creek water per day, which shows by test not more than 5 grains of scale-forming material per gallon after treatment. The cost per 1000 gal. of water is 1.63 cents. The daily cost of softening chemicals is about $1, whereas before the treating plant was installed the cost per day for compound was $2.40 and the load was less than at present. The chemicals are purchased by the carload at low prices, the soda ash costing 1 cent per pound and the lime 0.5 cent per pound.

All chemical charges to the ground mixing tank are weighed on platform scales and the tank is calibrated, so that by means of a measuring stick the strength of the solution can be determined. The mixing is done by an ordinary laborer under the direction of the chief engineer. After mixing, the charge is stirred, and while being stirred it is elevated to the upper tank by means of a Crane steam siphon, in about ten minutes, with a small expenditure of steam.

Tests to Determine Condition of Water

Each day the treated water is tested by the chief engineer, by means of a testing cabinet furnished by the manufacturer of the softener. This would seem to be a formidable venture, in view of the time and knowledge required to make a laboratory analysis of water. As a matter of fact, it is quite as simple as making a CO_2 analysis, and requires about fifteen minutes to perform. The test is conducted to determine (1) hardness, (2) causticity, (3) alkalinity.

The hardness test is made by placing 100 cu. cm. of the water to be tested in a bottle and adding a "standard soap solution" from a measuring burette. The bottle is then shaken and the soap solution added in small



FIGS. 2 AND 3—ARRANGEMENTS FOR CONSTANT-HEAD CONTROL

quantities until the lather will hold together firmly for five minutes. A little practice in this test will produce duplicate results within a reasonable practical error.

Causticity is determined by adding phenol to 100 cu. cm. of the water to be tested in a porcelain dish, the phenol serving as an indicator. An acid solution is then added from the measuring burette until the solution again becomes clear. The number of cubic centimeters of acid-testing solution added gives the measure of causticity.

The alkalinity test is made by adding methyl orange to the same water tested for causticity. The methyl orange gives this water a straw color. The acid-testing solution is again added from the burette until the indicator turns pink. The amount of acid-testing solution added gives the test for alkalinity.

The relations between alkalinity and causticity tests are important in showing correct treatment. The test indicating proper treatment should be about as follows: Hardness, 6; causticity, 4; alkalinity, 7.

TABLE II—OPERATING CONDITIONS BEFORE AND AFTER TREATING BOILER-FEED WATER

Item	Conditions Before Treating Water	Item	Results Secured by Treatment
1	Comparatively low economy of evaporation.	1	The coal bill has been reduced by 18 per cent of its former amount, based on the same load. The coal bill for July, the second month of use of the water softener, was $514 less than for May, when the softener was not in use—i.e., based on the same output.
2	Lost, on an average, thirteen boiler tubes per month, costing about $10 each, including cutting out old tubes and replacing new ones.	2	No boiler tubes have been lost since the softener began to effect results, in spite of the fact that the boilers have been above rating most of the time.
3	Rapid depreciation and high maintenance cost of brickwork due to extinguishing and starting of furnace fires.	3	The load has been carried on one 500-hp. and one 250-hp. boiler, whereas previously one 500-hp. and two 250-hp boilers were required. Incidentally, the load has increased while the horsepower of the boilers in service has decreased.
4	Loss of service of boilers and shut-downs due to loss of steam when tubes blew out.	4	Scale has practically disappeared, leaving the black iron.
5	Danger from explosion.	5	Maintenance and depreciation of brickwork have been diminished.
6	Loss of coal in burning down and building up fires and loss of heat in water.	6	Additional coal is saved, owing to lack of necessity of burning down and rebuilding fires and reheating water.
7	Continuously calking leaks in tubes and shells.	7	Danger of blow-out tubes eliminated
8	Compound deposits on feed-pipe valves.	8	Leaks stopped (Immediately after starting the softener, several leaks opened up in the tubes and shells of one boiler. This was caused by a fireman permitting low water, although the elimination of scale from the tubes and shells probably aggravated the conditions. After calking and rolling, no leaks have reappeared.)
9	Required to clean heater weekly and feed cold water to boilers while doing so. Heater never could be thoroughly cleaned.	9	No deposits on or eating out of valves.
10	Expense of frequent turbining of boilers (every three or four weeks) with consequent expense for hand-hole and man-hole gaskets, labor, power for turbine, etc.	10	Heater now washed out every two or three weeks (previously it was cleaned weekly). Very little deposit found. What little is found probably caused by overtreating the water slightly.
11	Turbo-generator sealing glands stopped up with scale, requiring turbine to be taken apart and cleaned, with consequent loss of service and with considerable expense.	11	No turbining required. It is anticipated that once a year will be sufficient.
12	Numerous other troublesome conditions of a minor character. In some cases even loss of vacuum was caused by scale.	12	Turbine glands remain clear. No cleaning required.
		13	Less loss from blowing down.
		14	No loss of vacuum from scale on atmospheric relief valves and other trouble caused by scale.

The results here tabulated have been shown by the use of the water softener two months and indicate that the external treatment of feed water at this plant returns a very handsome profit on the investment required. The apparatus cost about $3,000 installed.

TABLE I—ANALYSIS OF RAW CREEK WATER USED BY MINERAL POINT PUBLIC SERVICE COMPANY

Content	Grains per U. S. Gallon	Content	Grains per U. S. Gallon
Silicia	0.04	Sodium chloride	2.97
Iron and aluminum oxides	0.14	Total solids	29.96
Calcium carbonate	11.03	Incrusting solids	22.26
Magnesium carbonate	1.32	Organic and volatile matter	4.73
Magnesium sulphate	8.93	Alkalinity	12.60
Magnesium chloride	0.80	Hardness	22.00

This installation, in addition to furnishing treated water for the boilers of the central station, provides soft water for the Mineral Point & Northern Railroad Company for use in its locomotives. It is reported that a saving in coal similar to that of the operating company has been made, and, further, that fewer leaks are encountered. One of the engineers has stated that previous to using soft water he did not get out of the yards in the morning before his flues started leaking. Since using soft water he has had no more leaks. This also results in a saving of water, as a large amount leaked out on each trip. It is anticipated by the management of the railroad, based on the saving so far, that the saving in maintenance cost will be at least as great as the saving in fuel. The Chicago, Milwaukee & St. Paul Railway Company has also contracted for a supply of this water and is now using it.

The Mineral Point Public Service Company serves a group of cities in southwestern Wisconsin, as well as several zinc mines, with light and power. The station equipment consists of four 250-hp. and two 500-hp. Heine boilers, one 1200-kw. Allis-Chalmers turbine, one 1200-kw. Westinghouse turbine, and one 275-kw. directly connected Nordberg engine-generator set. The condensing water is cooled by a Stocker cooling tower and by a cooling pond recently constructed. Make-up water is pumped sometimes from a creek running past the power house and sometimes from wells.

The softener is made by the Northern Water Softener Company of Madison, Wis., and was installed by and is operated under the direction of the writer.

A Commutation Trouble That Was Traced to Poor Brushes

BY E. C. PARHAM

Copper brushes are little used on high-voltage commutating machines because carbon brushes place more resistance in the path of the short-circuit current and hold it to a comparatively low value without requiring design modifications that are expensive. The manufacturing companies have studied the qualities of carbon brushes required to give satisfactory commutation on standard machines, so that when an operator departs from the brush recommendations made by the manufacturer commutation troubles are often the result.

A certain substation contained two synchronous converters that were of the same size made by the same company. These machines were operated at the same speeds and presumably were similar in all respects. On one occasion a troubleman was called to ascertain why one of the machines sparked while the other machine did not. Both machines had been in operation for five years without developing trouble when one of them began to spark—not viciously, but enough to prevent the commutator from taking a polish. The inspector first checked the brush setting, the field connections and condition, the air-gap equalization, the brush tension and fit. He then went over the armature connections and the collector-ring taps to see if there was any evidence of poor connections, but no such evidence was found. Inspection of the brushes after they had operated on the commutator that had been just smoothed, however, disclosed a tendency on their part to pick up copper, while the brushes of the other machine exhibited no such tendency. When the brushes of the two machines were exchanged and allowed to run for several hours, the faultless commutator began to roughen, while the originally rough commutator began to develop a fine polish. It finally developed that the operator had been persuaded to buy a set of brushes that were apparently as good as the original brushes, which cost 50 per cent more. The new brushes might have been all right for a good many machines, but they were not adapted for this particular machine. Had they happened to be even less well adapted than they were, results might have been more expensive.

Indoor Type of Instrument Transformers Mounted for Outdoor Metering

In those cases where it is necessary to meter 4000-volt service out of doors, the Consolidated Gas, Electric Light & Power Company of Baltimore, Md., has devised a method of mounting indoor types of instrument transformers in a weatherproof case so that they may be used as shown in Fig. 1. In this instance the instrument-transformer case and the power transformer are mounted on the same platform, with the meter installed in a cabinet on the pole below where it can be easily read and tested.

The small indoor-type instrument transformers are mounted as shown in Fig. 2 in a condemned transformer shell. The sides of this casing are made removable so that the instrument transformers are readily accessible

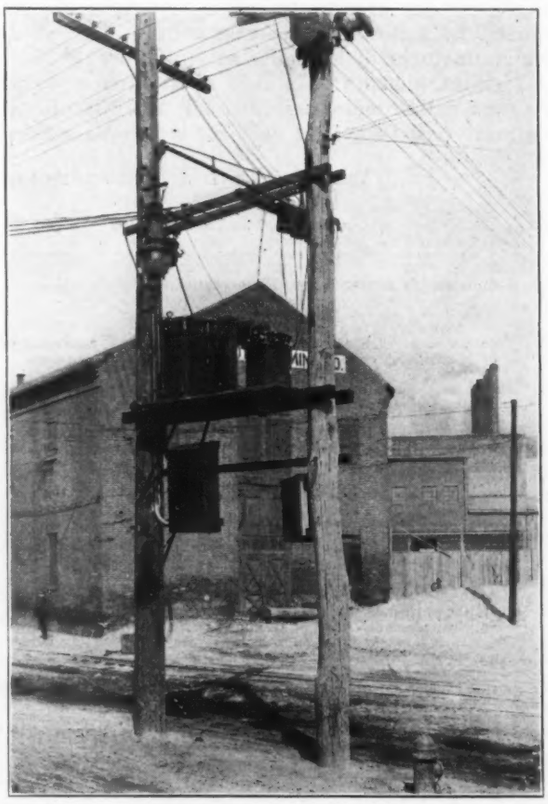


FIG. 1—ARRANGEMENT OF POWER TRANSFORMERS, AND INSTRUMENT TRANSFORMERS FOR OUTDOOR METERING

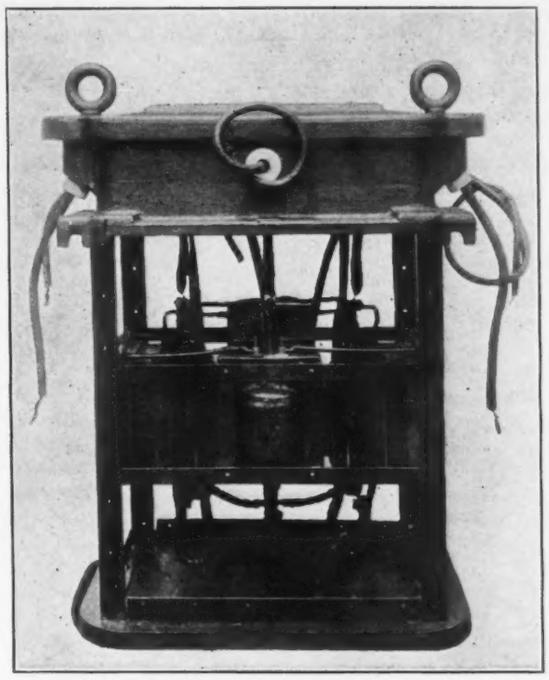


FIG. 2—INDOOR TYPE OF INSTRUMENT TRANSFORMERS MOUNTED IN AN OLD POWER-TRANSFORMER CASE

and can be removed in case of trouble without interruption of service. The casing is weatherproof, and the secondary leads from the transformers are carried through the bottom in conduit to the meter below. Formerly, in those cases where it was necessary to place metering equipment on the outside of the customer's building, small outdoor-type instrument transformers were required, three current transformers and two potential transformers. The use of the unit described has been found cheaper than outdoor units, and in addition has eliminated cross-arms on the pole to support the individual outdoor units.

Convenient Method of Tracing Grounds and Faults

BY H. S. KNOWLTON

Grounds on overhead lines and faults in duplex cables can be readily located with the triangular coil and telephone which were described on page 579 of the Sept. 11 issue of the ELECTRICAL WORLD. To trace leakage from overhead lines it is not necessary to climb the poles supporting the conductors. With the triangle held parallel to the line, the sound of the interrupted current is heard up to the fault. No sound is heard when the triangle is held at right angles to the line. With short-circuits, or in case of grounds on two-wire or loop street circuits, the current going out on one wire and returning on the other will cause a neutralizing effect, and no signal will be heard in the triangle; so that the transverse coil is best adapted for use in these troubles. Tree grounds and even slight leakages can be located on the ground at the butt of the tree. If any of the interrupted current is flowing down the tree, it can be heard by placing the triangle against the tree at right angles to the overhead line. If the triangle is placed against the tree and at the same time parallel to the line, the sound can be caused by induction from the line rather than from leakage down the tree. Grounds in underground cables other than the two-wire or loop style of street circuits can sometimes be traced with the triangle, provided that the fault is of low resistance and also provided there is sufficient ground distribution so that the outgoing current to the conductor is not entirely neutralized by the return on the sheath.

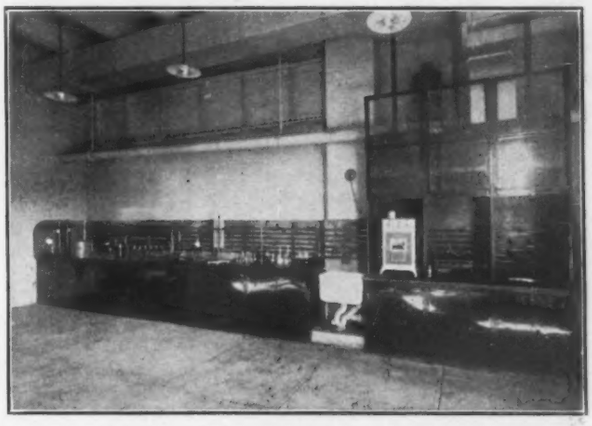
Faults in Duplex Cables

It is much easier to locate faults in duplex than in single-conductor cable, owing to the opportunity for checking one effect against another. Thus, with a short-circuit in a duplex system, using the transverse or horseshoe type of exploring coil, the signal will be of the same strength in each conductor when the coil is arranged for maximum sound, which is obtained by shifting the position of the coil around the cable, while with the coil equally inclosing both conductors the signal will diminish in intensity, owing to the neutralizing effect of the current going out in one and returning in the other conductor. This same effect indicates a closed loop in testing street-circuit duplex cable. In tracing a ground with the coil against the conductor carrying the signaling current, the sound will be loud, while against the other conductor the sound is weak and there is no neutralization. If beyond the fault, with no appreciable charging current beyond the break, the sound (if any) will be of the same strength all around the sheath, indicating sheath current only. If there should be charging current beyond the burn-out, sound will be heard a little louder against one conductor, but the difference on either side of the fault will be appreciable.

Facilities for Conducting Chemical Tests in a New York Central Station

A portion of the chemical laboratory in the 201st Street station of the United Electric Light & Power Company, New York City, is shown in the accompanying illustration. It is equipped to conduct any chemical experiments which may be required in a generating station. At the right are shown ventilated cabinets in which experiments with substances giving off noxious gases may be conducted. One of the cabinets contains an electrically heated oven in which coal samples may be dried or tested for volatile matter. The temperature is controlled by a thermostat attached to the range circuit. In the next cabinet is a gas-heated hot-plate, and in the third compartment is a basin connected with a drain.

Running along the wall back of these cabinets as well as above the experimental table on the left are six pipes having taps at several convenient points. The lower pipe connects with the drain, the next carries hot water, the third delivers cold water, the fourth is a gas pipe, the next supplies compressed air, and the upper one fur-



INTERIOR OF CHEMICAL LABORATORY IN STATION OF UNITED ELECTRIC LIGHT & POWER COMPANY

nishes low-pressure oxygen for incineration, oxidation, etc. Calorimeters, burettes, Bunsen burners and other portable appliances can be used on the experimental bench at the left.

At one side of the room (not shown) is a metal cabinet with glass panels in which chemicals and apparatus can be stored. Inclosed compartments for storing bulky and infrequently used apparatus and chemicals are provided below the experimental table, storage cabinet and ventilated compartments. A motor-driven coal crusher is provided for preparing coal for proximate and ultimate analysis. In other parts of the station are devices for obtaining long-period samples of flue-gas and continuous samples of coal while being delivered to the bunkers.

Among the duties of the chemist at this plant are the following: Obtaining proximate and ultimate analyses of coal; testing ash to determine the coal content; analyzing six-hour or eight-hour flue-gas samples every one or two watches; ascertaining the salt content of condensate from condensers every hour and from the boilers once a day; determining the amount of boiler-feed-water compound to use; investigating the nature of boiler-tube and condenser-tube scale; testing oils to determine which constituents are desirable for specific purposes; experimenting with metals and alloys to determine suitability for condenser tubes, etc.; checking coal, oil and other materials purchased to see that they follow specifications, and checking up station-performance curves.

Portable Derrick for Handling Pole Transformers

BY ROBERT FERRIS

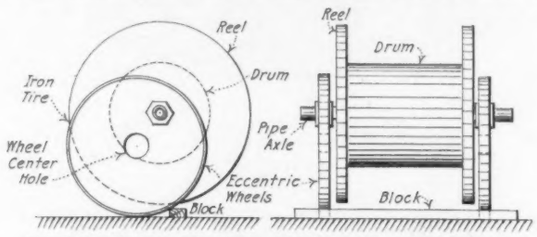
The portable derrick for handling transformers described on page 1091 of the Nov. 13 issue of the ELECTRICAL WORLD has interested the writer on account of the fact that a similar device is being used on the lines of the Yankton (S. D.) Light, Heat & Power Company. The accompanying illustrations show the derrick in use and raising a 7.5-kw. transformer. It is sufficiently strong to raise even a heavier unit, as shown by the fact that it is supporting the weight of a lineman standing on the transformer.

The upright part of this derrick is made of a piece of 2-in. pipe 5½ ft. long. The cross-piece is a bar of steel 2¼ in. by ½ in. by 4 ft. long. A ⅝-in. rod provided with a hook at each end connects one end of the cross-piece and the bottom of the upright pipe. The outfit is easily handled by one man, and the three pieces are raised separately and assembled on the pole. The dimensions of the derrick arm are such that the transformer is 18 in. from the face of the pole while being raised. When raising a transformer the fall line from the snatch block used is attached to a truck, which pulls the unit into position, making the work easy for the linemen.

RAISING A 7.5-KW. TRANSFORMER INTO POSITION ON A POLE

Home-Made Reel Stands for Stringing Transmission-Line Conductors

Instead of purchasing steel-track jacks with special heads and bases for reel stands, the construction crews of the Southern Wisconsin Power Company use home-made equipment for this purpose. A pair of special steel jacks costs about $25, while the home-made reel stand of the type shown in the accompanying illustration costs about $12. One of these stands consists in the main of an iron-pipe axle at the ends of which are attached eccentric steel-tired wooden wheels.



CONSTRUCTION OF REEL STAND AND WIRE DRUM

Details of the wheel and axle construction may be varied to suit conditions, but for stringing high-tension lines the Southern Wisconsin Power Company uses wheels made from two layers of 1-in. plank laid at right angles to each other and bolted together with 0.25-in. carriage bolts. The bolted planks are sawed into wheels on a band-saw and 3/16-in. iron tires are heated and shrunk into place on the wheel rims. The iron-pipe axle is threaded at each end to receive four large nuts to hold the wheels in place.

When assembling the stand in the field the axle is slipped through the conductor reel and a single nut is placed on each end of the axle with the washers facing outward. The eccentric wheels are then placed on the axle and drawn snugly against the inside nuts and washers by a second set of nuts placed outside the eccentric wheels. By rolling the eccentric wheels the conductor reel will swing free of the ground and in a position ready to "pay out" the wire.

Braking on these reel stands is accomplished easily by placing a piece of timber against the flange of the conductor reel.

How Individual Draft Control Proved Advantageous

One morning just as the load in a generating station was coming on the steam pressure began to drop suddenly. A hasty examination showed that an automatically regulated damper in the main flue, which had been almost closed during the previous night's light load, failed to work, although the regulator controlling it was operating freely. A closer inspection showed that the bolts which held the damper to the operating bar had sheared off. Since hand-operated dampers were installed in the flues from each boiler, the main damper was blocked in the full-open position and the individual dampers were employed to regulate the draft. Later,

when time afforded, the main damper was removed and its automatic regulator connected with one of the individual dampers. Other regulators were attached to the remaining dampers. While this change was brought about by accident, better steam-pressure regulation is now maintained and the steam economy is consequently improved.

This example seems to show an advantage in having automatic regulators control individual units rather than a group. With this arrangement an accident to one damper or its regulator will not cripple the entire plant as did the failure of main damper in the instance cited. Certainly, if facilities for independent operation of electrical units are desirable, they should be equally advisable for the steam-generating end of the station, not only as regards draft control but also with respect to supplying feed-water and fuel.

Ways of Anchoring New Foundations to Old Ones

BY HENRY C. ERHARDT

When old plants are undergoing rearrangement, or when additions are being made, it is often necessary to utilize old foundations or portions of them for supporting the machines. In these cases conditions are frequently such that the old foundations must be enlarged by the addition of new material. In modern construction concrete is the material almost universally used. The tops of the old foundations are usually greasy and dirty, and it is seldom that there will be a dependable bond between the upper surface of the old foundations and the lower surface of new material, even if a ¼-in. or ½-in. layer be chipped from the former. On this account it is usually desirable to "tie in" the new concrete to the old foundation.

Methods of attaching new concrete foundation material to an old foundation which may be of stone, brick or concrete are shown in Fig. 1. Where the concrete to be added constitutes a thin slab it is usually desirable to use steel anchors, as shown at *A*, *B* and *C*, which will not only prevent longitudinal movement of the slab but will also prevent it from rising. One good method of effecting such an attachment is that indicated at *A* and *B*, wherein sections of mild-steel reinforcing rod of the split type are used. The lower end of each of these ties is split from its bottom up to the lowest hole through it. When the rod is driven down in a hole, as shown in Fig. 2, the wedge forces the lower ends apart. This binds the tie rod firmly in position in the old masonry, with the deformed upper end *D* projecting and effectively preventing the lifting of the concrete slab ultimately poured around it. A cement grout poured in the holes in the old masonry will hold these tie rods securely.

Another method of attaching a slab to old masonry is shown at *C*, where a threaded rod is used for a tie. One end of the rod on which a nut has been turned is set down in a hole in the old masonry, and the hole is filled with grout, which anchors the tie in place. On its upper end two nuts with a washer or plate between are used.

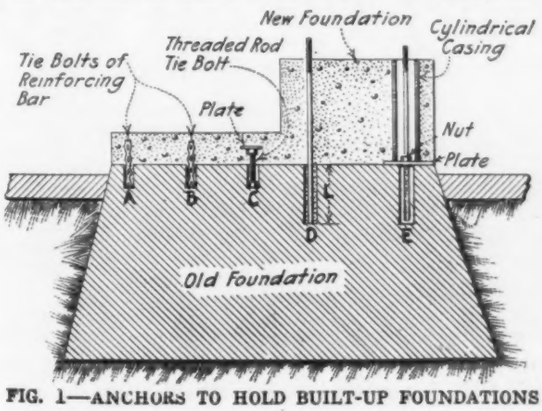


FIG. 1—ANCHORS TO HOLD BUILT-UP FOUNDATIONS

Where the masonry which is to be added is of such thickness that its weight will prevent it from being raised vertically, ties to prevent vertical displacement are seldom necessary. The anchor bolts, such as *D* or *E*,

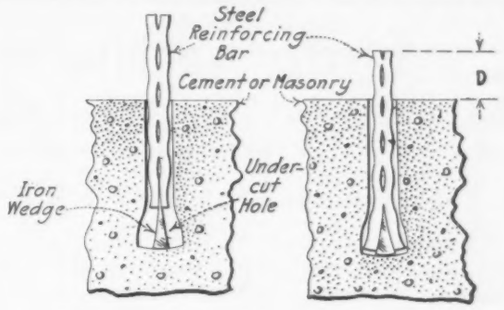


FIG. 2—WEDGES TO BIND TIE ROD IN OLD MASONRY

which should pass through the new concrete down into the old foundation, will prevent lateral displacement and the weight of the concrete will prevent its being raised vertically. Where plain rods are used for bolts they can be set as shown at *D*. If casings are to be used around the bolts, they may be arranged as indicated at *E*. If the distance *L* (Fig. 1) is equal to twenty-five or thirty times the diameter of the rod, the rod will break before it can be pulled from the old masonry.

Life Data on Power-Plant Equipment Used in Valuation of Massachusetts Property

In a valuation of the property of the Bay State Street Railway of Boston, Mass., recently submitted to the Massachusetts Public Service Commission in connection with proceedings for a proposed fare increase, a protracted study was made of the life of equipment by the consulting engineers of the company, Sloan, Huddle, Feustel & Freeman of Madison, Wis. Estimates based upon an eighteen months' investigation of the system, which comprises nearly 1000 miles of track, include the following life data:

Equipment	Life in Years
Boilers (water-tube)	25–30
Boilers (fire-tube)	20
Engines	30–40
Turbo-generators	20
Condensers (steam)	20–25
Pumps	12–20
Stokers	15
Heaters	25–30
Coal-handling machinery	25
Piping	25
Generators (direct-current)	30–40
Alternators	25
Switchboards and wiring	Average of generator served
Iron poles	40
Cedar poles	20
Chestnut poles	16
Hard-pine poles	12
Cross-arms	10
Guys and anchors	16
Miscellaneous work on poles	15
Telephone sets	10
Iron-box telephone sets	14
Telephone wire	15
Submarine signal cable	10
Submarine telephone cable	10
Underground telephone cable	30
Underground signal cable	30
Hand-thrown signals	10
Automatic signals	14
Signal wire	15

Marketing Electricity

A Department on Selling Service and Widening the Use of Electrical Energy

Electric Cooking to the Housewives' Rescue

How the Little Rock (Ark.) Central-Station Company Served Its City in a Crisis, Demonstrating the Practicability of Electric Cooking to the Local Public

BY ARTHUR E. SMITH, COMMERCIAL MANAGER LITTLE ROCK RAILWAY & ELECTRIC COMPANY

IN a Southern city like Little Rock, Ark., gas is naturally used extensively for domestic cooking, and a failure of the gas supply causes an acute crisis in the homes. Such a predicament recently brought to the Little Rock Railway & Electric Company a rare opportunity to render a conspicuous demonstration of the generous standard of service which it is endeavoring to maintain, and incidentally to focus the attention of the public on the convenience and practicability of modern electric-cooking appliances in a way that years of ordinary selling effort could not equal.

Gas Failure Brings a "Run"

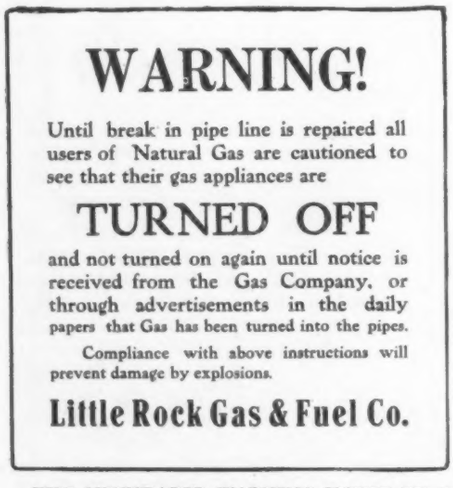
At my home on Monday morning, May 3, I picked up the morning paper at the breakfast table to glance over the headlines and saw to my surprise that a rise in the Red River had caused a break in the natural-gas line and cut off all supply from Little Rock. This natural gas is piped from the Caddo gas fields in southern Louisiana and crosses the Red River in the southern part of Arkansas. High waters had come unexpectedly at this point and washed out the line. So, though it was some time before the usual hour for opening the office, I went down town as quickly as possible, without stopping for breakfast, and found a number of people already waiting at the door of the electric shop, eager to purchase electric-cooking appliances to enable them to cook their meals. There was a "run" on the electric shop all day.

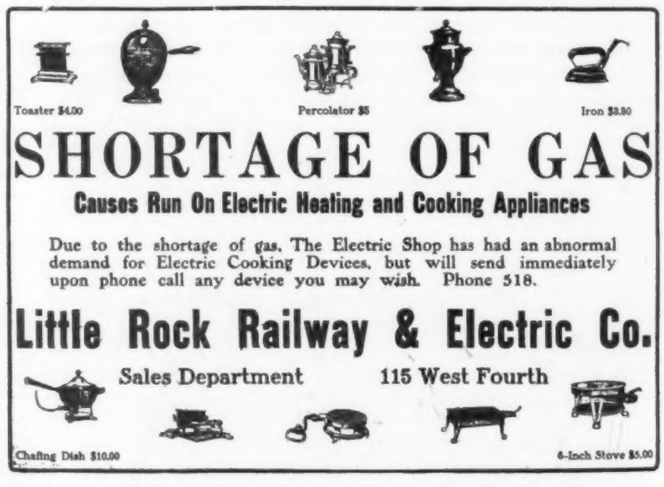
New Electric Shop Just Ready

On April 1 the Little Rock Railway & Electric Company had moved its appliance salesroom down town to the center of the shopping district and opened an electric shop. Business had been good throughout the month, and, owing to the work involved in establishing the new shop, no large reserve stock of appliances had been purchased. The unexpected failure of the gas supply brought such a rush of orders that by 2 o'clock in the afternoon that day our entire stock and every device that could be secured from local dealers had been sold, and there were no more electric-cooking appliances of any description to be had in Little Rock. As soon as the "run" began, however, we had telegraphed to several manufacturers and various jobbers in cities round about to rush us more goods by express. We received some of these shipments on Tuesday morning, but in the meantime we had already taken orders for more than we could supply, and we were sold out again completely by Tuesday afternoon. On the 8 o'clock train on Tuesday night, however, we received a further lot of 200 grills which had fortunately been already on the way for "Hotpoint Week," and three automobiles were pressed into service at once to make deliveries. Every order still unsatisfied was taken care of that night, though before the last delivery was made everybody had gone to bed and it was necessary to wake them up and get them downstairs to receive the wherewithal to cook their morning's breakfast. Invariably the customer thanked us heartily and complimented the company on the eager service it was rendering to the community.

"It's an Ill Wind," etc.

Of course, the gas company had to warn all gas consumers to turn off all burners to prevent explosions when the service was restored, and the newspapers were full of similar warnings and bulletins in regard to the work on the line and the difficulties that were being


WARNING!
Until break in pipe line is repaired all users of Natural Gas are cautioned to see that their gas appliances are
TURNED OFF
and not turned on again until notice is received from the Gas Company, or through advertisements in the daily papers that Gas has been turned into the pipes.
Compliance with above instructions will prevent damage by explosions.
Little Rock Gas & Fuel Co.


Toaster $4.00
Percolator $5
Iron $3.50
SHORTAGE OF GAS
Causes Run On Electric Heating and Cooking Appliances
Due to the shortage of gas, The Electric Shop has had an abnormal demand for Electric Cooking Devices, but will send immediately upon phone call any device you may wish. Phone 518.
Little Rock Railway & Electric Co.
Sales Department
115 West Fourth
Chafing Dish $10.00
6-Inch Stove $5.00

THE NEWSPAPER WARNING ISSUED BY THE GAS COMPANY, AND THE ADVERTISEMENT PUBLISHED BY THE ELECTRIC COMPANY TAKING ADVANTAGE OF THE SITUATION AND COMING TO THE HOUSEWIVES' RESCUE

caused industrially as well as in the homes. Naturally this brought us the most beneficial publicity. It was more than two weeks—until May 20 to be exact—before gas was again available, and the sale of electric-cooking devices continued in unprecedented volume.

The troubles of the gas company were not yet over, however. After temporary repairs had been made a higher stage of water brought another break just five days later, with no more gas until June 10. A third break followed on June 15, which lasted until June 23, at which time the gas people asserted that no further trouble was possible; but again, on Aug. 25, there was a break that was not overcome until Sept. 5. It made a harvest time for us, though naturally the rush of business never quite equaled the record that was made in the first few days.

Actual Results in Figures

To show how great the effect was, it is interesting to compare our appliance sales for 1914 and for the first ten months of 1915, a period when general business conditions in Little Rock were in no way as good as in the year before. Whereas in 1914 we sold 723 electric irons and 256 other appliances, from January through October of this year we disposed of 864 irons and 843 other devices. In all, 471 irons and 662 miscellaneous appliances were sold during the months of May, June, July and August.

As was to be expected, the sudden adoption of electric cooking by many families previously unfamiliar with the use of electric appliances led to numerous cases of misunderstanding and complaint of high bills. We had several instances where bills which were normally $2.50 jumped up to $18 or $20 for the first month, owing to the constant and injudicious use of electricity. In some places the cook had kept a kettle boiling all day long on an electric hot-plate. In every case we adjusted these bills in a way that left the customer entirely satisfied, for the situation had brought us a wonderful opportunity to demonstrate to the entire city the practical utility of electric service for cooking in the home, and we were unwilling to let any unfortunate accidents due to inexperience create a hurtful counter influence. As it is, we believe that popular education in the use of electrical appliances has developed further in the year 1915 in Little Rock than in six years before.

INTERIOR OF THE LITTLE ROCK ELECTRIC SHOP THAT SUCCORED THE CITY WHEN THE GAS SUPPLY FAILED

The Employee and the Customer as Seen in the Woonsocket (R. I.) Service Code

As in merchandising fields everywhere, the attitude of the employee of a central station toward the customer is a powerful factor in the business success of the company. There is nothing new in this, of course, and yet it is possible for operating companies to emphasize it in a fresh way, judging from a "service code" which has recently come to hand from the Blackstone Valley Gas & Electric Company of Woonsocket, R. I., one of the Stone & Webster properties. The company has incorporated the word "service" into its trademark, and the code has been issued in a twelve-page pamphlet of pocket size for the benefit of employees in their relations with the public. It illustrates the facility with which the fundamental principles of such relations can be put in permanent form and is helpful in teaching new men who join the sales staff the proper attitude toward customers.

The code points out that not only does "service" include an uninterrupted supply of electricity and gas but it also requiries that all dealings with present and prospective customers be conducted in a frank, honest and courteous manner. Back of this word "service" are electric power stations of over 30,000-hp. capacity and a gas plant with a daily capacity of 3,750,000 cu. ft., both of which have an enviable record for continuous operation, first-class distribution systems, a highly efficient corps of trouble men on duty day and night, and behind this and making it possible an alert and effective organization of employees. It is recognized, however, that without the customer there would be no company and that the satisfied customer is the company's greatest asset. "Service," in the view of the code, means the limit of courteous, efficient attention to each particular customer or request, and it recognizes that the new customer is just as valuable as the old one; for each new customer is really an old customer in the making.

The Spirit of the Code in Epigram

The spirit of the code is illustrated in such sentences as these: "See that you do your part to make the customer feel that everybody's business is appreciated." "Impress upon him the fine good-fellowship in our company, the 'no-trouble-to-show-you' spirit." "You must take the customer and handle him according to the conditions and the particular mood in which you find him." "The stranger in antiquated raiment may be one of the best customers on our books." "Always remember, the customer pays your salary. He is your immediate benefactor." "An employee can wait on a customer in a 'What-do-you-want?' manner that will remain in the customer's mind, make him feel that there is something radically wrong with our business, and make him regret he came in, or he can wait on the customer in such a manner that he will go out of his way to do business with us." "If a customer asks for a quick connection, don't get rid of the matter by answering, 'It will be made right away,' without getting information from the operating department as to the possibility of accommodating the customer." "It would be better to lose the order than to have a disappointed customer on account of not being able to carry out your promise." "An employee who is quick to answer telephone calls and does not keep a customer holding a cold receiver to his ear, listening intently to nothing, can swell the appreciation of our service and of himself or herself." "Wrangling with the customer should have no place in the company." "Everybody from the errand boy up to the boss is working all the time to give the customer the service he wants."

Calculating Wire Sizes for Direct-Current Circuits

BY LOUIS W. MOXEY, JR., VICE-PRESIDENT KELLER-PIKE COMPANY, PHILADELPHIA

The computation of conductor resistances, voltage drops, and the necessary sizes of wires for direct-current circuits, is discussed in the present article, which is the fourth to appear in the series on elementary principles of the electrical contracting business, prepared by Mr. Moxey. The three preceding articles, which dealt with business methods, labor costs and accounting, appeared respectively in the issues of Oct. 16 and 23 and Nov. 20. The subject of conductor calculations for alternating-current circuits will be taken up in the next installment, to be printed next week. Topics of illumination and overhead and underground construction are to be discussed in the remaining articles of the series, to appear in the closing numbers of the present volume of the ELECTRICAL WORLD.

THE subject of voltage drop is one to which many electrical contractors, architects and engineers give very little attention. It is for this reason that the subject of the calculation of resistances, voltage drops and necessary sizes of wires, etc., has been included in this series of articles. The information given on these subjects is by no means intended by the writer as a treatise on electric wiring, but rather as general information which it is hoped will be of some value to electrical contractors, architects, engineers and owners.

Some of the formulas with which the writer is acquainted as recommended for computing voltage drops are not applicable to all systems of wiring. In many cases it is found that contractors are almost helpless when it is necessary to compute the voltage drop in even a small-size job. As a result lamps in many installations do not burn at maximum efficiency owing to excessive voltage drops. It is with the hope of rendering the calculation of voltage drop comparatively easy that the following discussion of voltage drop in direct-current and alternating-current circuits is given.

There are two factors that should be considered in laying out any direct-current circuit. First, the heat loss, which depends upon the value of the current and the material and size of the wire, must be considered. The amount of this loss in watts is equal to the product of the square of the current in amperes multiplied by the resistance of the conductor in ohms, or C^2R. This heat loss is very seldom computed, as the Underwriters' requirements are intended to keep this loss well within the limit of safety. The carrying capacities of the various sizes of wire, as specified in the National Electrical Code, are such as to keep the temperature rise within safe limits for the type of insulation employed.

A size of wire, therefore, should be figured that will meet the pressure requirement and at the same time meet the requirements of the code in regard to safe carrying capacities.

By Ohm's law the allowable resistance in any wire to meet the voltage-drop requirement can be found by dividing the permissible loss in volts by the current, $R = E/C$, the resistance being in ohms. For example, what should be the resistance of a wire in which a current of 100 amp. is flowing, to give a voltage drop of 5 volts?

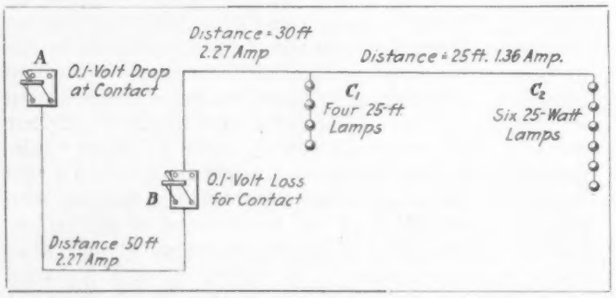
$$R = 5 \div 100 = 0.05 \text{ ohm}$$

Suppose the distance to be 250 ft. Then the circuit distance, assuming it to be a two-wire system, is 500 ft. A size of wire is required which will have a resistance of 0.05 ohm for a 500-ft. length. The writer employs tables which give the resistance of all sizes of wire in lengths of from 10 ft. to 1000 ft. at 10-ft. intervals. A sample table is given in Table XXVII. Complete tables of the same or similar nature can be found in numerous handbooks, textbooks and wire manufacturers' literature. When tables such as these are examined it will be found that the size of wire would be No. 0. Tables as indicated should be made or obtained for all sizes of wire used in practice.

If such tables are not at hand, as in the case of work on a small job away from the office, one can obtain the size of wire required by remembering that 1000 ft. of No. 10 B. & S. gage wire has a resistance of approximately 1 ohm at 68 deg. Fahr., and that an increase of three sizes in the gage number divides the resistance by approximately two, and vice versa. Thus the resistance of No. 7 wire is half that of the same length of No. 10 wire, and the resistance of No. 13 wire is double that of the same length of No. 10 wire.

Consecutive sizes of wire differ in resistance by approximately the cube root of 2 (about 1.25); that is, the resistance of a definite length of No. 11 wire is approximately equal to one and a quarter times the resistance of the same length of No. 10 wire, and the resistance of a definite length of No. 9 wire is approximately equal to the resistance of the same length of No. 10 wire divided by 1.25. For a difference in gage number of two, the corresponding factor is the cube root of 4, or 1.58. By keeping these figures in mind the resistance of any length of any size of wire can be determined with a fair degree of accuracy.

In a three-wire, direct-current balanced system no current flows in the middle wire if a true balance exists. For such a system the size of the wires is determined as in a two-wire system, the middle wire being made as large as the outside ones for safety, although some engineers will permit the middle wire to be made smaller in size.



CIRCUIT ILLUSTRATING CONDUCTOR AND CONTACT DROP

TABLE XXVII—RESISTANCE IN OHMS OF NO. 0 B. & S. GAGE HARD-DRAWN WIRE AT DIFFERENT LENGTHS AT 70 DEG. FAHR.

Feet	0	10	20	30	40	50	60	70	80	90
0	∞	.00099	.00199	.00299	.00399	.00499	.00598	.00698	.00798	.00898
100	.00998	.01097	.01197	.01297	.01397	.01497	.01596	.01696	.01796	.01896
200	.01996	.02095	.02195	.02295	.02395	.02495	.02594	.02694	.02794	.02894
300	.02994	.03093	.03193	.03293	.03393	.03493	.03592	.03692	.03792	.03892
400	.03992	.04091	.04191	.04291	.04391	.04491	.04590	.04690	.04790	.04890
500	.04990	.05089	.05189	.05289	.05389	.05489	.05588	.05688	.05788	.05888

TABLE XXVIII—RESISTANCE IN OHMS OF ANY CIRCUIT CARRYING A GIVEN NUMBER OF AMPERES WITH A DROP OF 2.5 VOLTS

Current	0	1	2	3	4	5	6	7	8	9
0	∞	2.5000	1.2500	.8333	.6250	.5000	.4166	.3571	.3125	.2778
10	.2500	.2272	.2083	.1923	.1786	.1667	.1562	.1470	.1389	.1316
20	.1250	.1190	.1136	.1087	.1042	.1000	.0961	.0962	.0892	.0862
30	.0833	.0806	.0781	.0757	.0735	.0714	.0694	.0676	.0658	.0641
40	.0625	.0609	.0595	.0581	.0568	.0555	.0543	.0532	.0521	.0510
50	.0500	.0490	.0481	.0472	.0463	.0454	.0446	.0438	.0431	.0424
60	.0417	.0410	.0403	.0397	.0391	.0384	.0379	.0373	.0368	.0362
70	.0357	.0352	.0347	.0342	.0338	.0333	.0329	.0325	.0320	.0316
80	.0312	.0309	.0305	.0301	.0297	.0294	.0291	.0287	.0284	.0281
90	.0278	.0275	.0272	.0249	.0261	.0263	.026	.0258	.0255	.0252

Other voltage drops must be taken into consideration in addition to that due to the resistance of the wire. Such are those at cut-outs, panelboards and switches. On main circuits an allowance of 0.1 volt for each connection should be made, while on branch circuits an allowance of 0.1 volt at all cut-outs and switches should be made.

In figuring the resistance and other drops in branch circuits the same method is employed for either direct current or alternating current. The voltage drops on branch circuits should be figured separately for each length of circuit between outlets. For example, in the sketch A is the panelboard and B a switch. C_1 and C_2 are lamp outlets. A two-wire system of distribution is assumed and the distances given are one-way distances only.

At C_1 there are four 25-watt lamps and at C_2 there are six 25-watt lamps. If a 110-volt system is installed, No. 14 wire would give a drop of 1.29 volts, as follows:

Resistance of No. 14 wire:

A to B (100 ft.) = 0.2567
B to C (60 ft.) = 0.154
C_1 to C_2 (50 ft.) = 0.1283

By Ohm's law:

0.2567 ohm × 2.27 amp. = 0.58 volt
0.154 ohm × 2.27 amp. = 0.34 volt
0.120 ohm × 1.36 amp. = 0.17 volt
Total line resistance drop = 1.09 volts
Assumed loss at contact A = 0.1 volt
Assumed loss at contact B = 0.1 volt
Total drop A to C = 1.29 volts

Size of Wire for Given Voltage Drop

In many cases it is necessary to know what size of wire will be required with a definite length of circuit to give a certain voltage drop with a certain current. Suppose, for example, that it is necessary to transmit electrical energy a distance of 205 ft. with a drop of 2.5 volts, the system being a direct-current 110-volt one, the current being 62 amp., and the 205 ft. being single distance.

For a drop of 2.5 volts and a current of 62 amp. the resistance should be 2.5 ÷ 62, or 0.0403 ohm. If tables are at hand showing the resistances required with different currents to give various voltage drops, this calculation is unnecessary. Such tables, where used, can be made in the form shown in Table XXVIII. This table gives resistances required for 2.5 volts drop for currents of 0 amp. to 99 amp. in steps of 1 amp. For higher currents one should remember that multiplying the current by 10 in the table multiplies the resistance values by 10. This table could have been applied in the case given by following the horizontal line marked 60 and the vertical line marked 2 (a total of 62 amp.) until they meet, at which point the resistance of 0.0403 ohm is obtained. After the ohmic resistance is found—namely, 0.0403 ohm—one can find the corresponding size of wire—namely, No. 0—by means of tables such as Table XXVII, or by means of the relation existing between sizes of wire.

The following article will treat of the calculation of wire sizes for alternating-current lines.

Electric-Heating "Preparedness" for Coming Cold Weather

The Kansas City Electric Light Company recently presented a timely window display the keynote of which was expressed in a streamer bearing the one word "Preparedness." The display consisted of cooking devices and other appliances using electricity, the central figure being an electric radiator. Kansas City has been much perturbed over the prospects for adequate gas supply this fall and winter, particularly when touches of wintry weather have brought inconvenience to gas users.

Merchants' Holiday Decorations Encourage Early Christmas Shopping

The sidewalk decorations shown in the accompanying picture were installed last year by the Hart-Albin Company, Billings, Mont., to encourage the "early shopping" idea among its customers. No sooner were the festoons in place—about Dec. 1—than the merchants in the entire block took it upon themselves to subscribe enough money to install festoons throughout the district. Considerable public comment was caused by the display. The merchants in the block also expressed themselves as well pleased with the results, declaring at the end of the Christmas campaign their belief that the electrical decorations helped to increase their sales materially.

J. F. Roche, manager of the Billings branch of the Montana Power Company, points out that in order to promote such a display the local electric company must furnish the initial ideas and should submit sketches showing the local business men how the decorations will look when installed. The lamps should be colored in holiday tints and nothing left undone that will add to the Christmas character of the celebration. The "early shopping idea" is always impressed upon the public mind by such a display in operation early in the Christmas month. The display also offers an opportunity for the company to obtain the good will of its customers and emphasizes the fact that electricity for publicity is the coming method of advertising for the merchant.

A MERCHANT'S DISPLAY TO ENCOURAGE EARLY SHOPPING AT BILLINGS, MONT.

Boulevard Lighting System with Novel Street Designation

In an outlying residential section of Omaha, Neb., known as Happy Hollow, the Omaha Electric Light & Power Company is furnishing service for an attractive boulevard lighting system. This consists of pressed-

COMBINATION STREET SIGN AND BOULEVARD LIGHTING POST

metal posts spaced 100 ft. apart on the average and equipped with 100-watt nitrogen-filled series lamps and large opal globes. The corner posts are fitted with brackets extending up on four sides of the globe and holding a glass plate on each side on which is lettered the street name. The sign is clearly legible both by night and by day, since the light shines through the glass, making the letters stand out boldly against the bright background.

Electric Company Building Sets Example of Outline Lighting for St. Joseph (Mo.) Merchants

The St. Joseph (Mo.) Railway, Light & Power Company illuminates its office building more completely than any other building in the city. As a result the structure stands out as a brilliant example of the attractiveness and the advertising merit of display lighting. The twenty-eight flaming torches between the windows are operated by a flasher controlling the red lamps and producing red flame emanating from the torches made up of white lamps. These torches are intended to be symbolic at once of the company's several services—heat, light and power.

Christmas Discounts to Providence Central-Station Customers

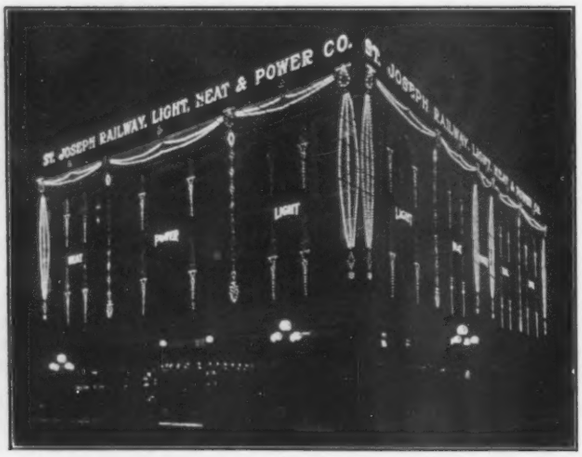
The Narragansett Electric Lighting Company of Providence, R. I., reports that, following its special nine-day lamp sale, which disposed of over 41,000 tungsten lamps, comprehensive preparations have been made for the Christmas campaign, which is now well under way.

Although it is customary for merchants to buy special merchandise for the holidays and to place on it holiday prices which are usually higher than the regular prices, the Providence electric shop is sending to every customer of the company a special coupon which will entitle the holder to a special Christmas discount of 15 per cent on purchases made either at the electric shop or any of the Narragansett company's branch offices.

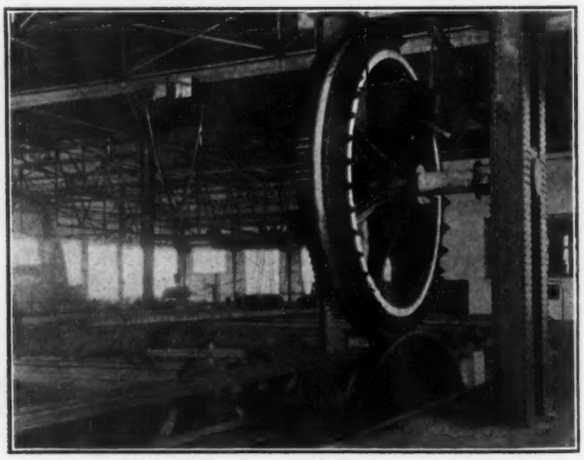
A special feature of the electric shop will be a very spectacular window display which has been planned for the sole purpose of attracting attention to the store and stopping the passer-by. This display will represent a winter scene with painted background and with mechanical toys, such as battleships, passenger trains, freight trains, aeroplanes, etc., in operation. A special circular letter will be sent out to 25,000 customers calling their attention to the electrical Christmas gifts on display at the electric shop and offering to defer the billing of all Christmas purchases until Feb. 1.

Largest Rotary Shear Driven by 50-hp. Induction Motor

In the plant of the Bates Expanded Steel Truss Company at East Chicago, Ind., a motor-driven shear, which is said to be the largest rotary shear in the world, is used for slitting steel I-beam sections. This slitting operation is a part of a process for making latticed non-fabricated steel poles. The shear itself weighs about 100,000 lb. and carries cutting disks which are 12 ft. in diameter and weigh 16,000 lb. each. A 50-hp., 220-volt, sixty-cycle motor operating at 900 r.p.m. drives the shear through a gear reduction with a ratio of 450 to 1, so that the cutting disks travel at the rate of 2 r.p.m. When revolving at its rated speed this machine will shear a steel section for a 35-ft. pole in thirty seconds.



THE TWENTY-EIGHT FLAMING TORCHES BETWEEN THE WINDOWS ACCENTUATE THIS OUTLINE LIGHTING



MOUNTED IN PLACE, THIS HUGE SHEAR EXTENDS 10 FT. BELOW THE FLOOR IN A CONCRETE PIT

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INSULATION MEASUREMENTS

Determining Status of Insulation Resistance of a Network and Simple Portable Instruments for This Purpose

In large industrial districts the great importance of making exact quantitative insulation measurements of the different portions of the network has been recognized, inasmuch as short-circuits with their evil consequences are thereby avoided. In an article by J. F. van Lonkhuyzen in the *Elektrotechnische Zeitschrift* for Sept. 16, 1915, the whole subject of insulation measurements is discussed, and it is recommended that not only the insulation resistance of parts of the network but also that of dynamos, motors, transformers, etc., be determined. The portable insulation meters suitable for this purpose may also be used to advantage in laboratories and workshops for controlling the process of drying of impregnated windings, also for testing insulation materials, etc. Insulation measurements are distinguished from ordinary resistance measurements by the fact that the results of the measurements depend to a certain degree on the voltage used. This is due to the fact that when the voltage is above a certain value little air-gaps, etc., in the dielectric are bridged. For this reason the regulations of the German Association of Electrical Engineers require that insulation measurements be made with at least 100 volts and preferably with the normal voltage of the network. Insulation measurements with a voltage meter are the simplest method. This method, however, has certain disadvantages. These are avoided by a second method, in which the instrument used contains two coils mounted on the same axle. These two coils are moving in permanent magnetic fields in such a way that when the one coil moves in a uniformly increasing magnetic field the other coil moves in a homogeneous or uniformly decreasing magnetic field. When current passes, the second coil gives a torque opposite to that of the first coil. Current is conducted to the two coils by thin ribbons which have a negligible directing force. If the two coils are connected as shown in Fig. 1, so that the main coil is supplied with the same current i which passes through the resistance X to be measured, while the second coil measures the voltage e at the terminals of the resistance X, then the deflection of the needle is proportional to the ratio of the two values e and i. Tang $\alpha = ce/i = cX$.

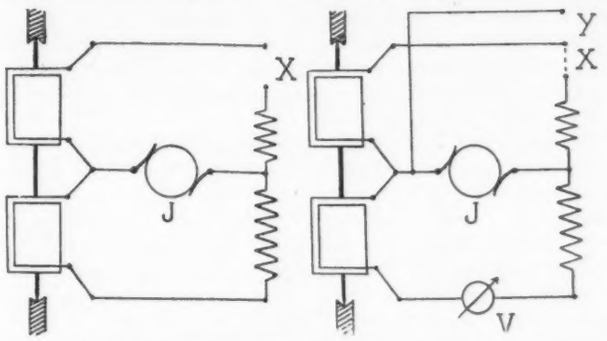


FIG. 1—CIRCUIT FOR INSULATION MEASUREMENT WITH MEGOHM METER

FIG. 2—CIRCUIT FOR INSULATION AND RESISTANCE MEASUREMENT

In contradistinction to the voltmeter method, resistance measurements based on this principle are theoretically independent of the voltage of measurement. In practice it is necessary not to use too low a voltage since the total torque might then become too small to give a reliable reading. For zero voltage the torque is also zero and the needle may assume any position on the scale.

By the use of this method exact insulation measurements become possible with portable instruments, since the voltage variations of the inductor machine actuated by hand have no disturbing effect on the result. Another advantage of the method is that it is not necessary to connect the resistance Y to be measured in series with the main coil, but it may be connected in parallel with the main coil. Since the current i in the main coil is in this case inversely proportional with the current in Y, the readings of the instrument again depend only on one constant and on the value of Y. We have tang $\alpha = c/Y$. For the resistance in parallel with the main coil the scale runs, therefore, in the opposite direction to the scale for the case in which the resistance is in series with the main coil (Fig. 3). In the parallel case resistances of the order of magnitude of 10, 100 or 1000 ohms can still be exactly measured. This is the order of magnitude of protective earth connections, so that in this way the use of the insulation meter may be extended to measuring the resistance to earth connections. The possibility of constructing a reliable inductor machine is discussed in concluding the article.

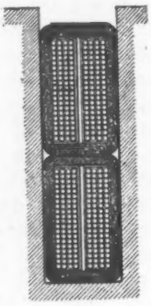
FIG. 3—SCALE OF MEGOHM METER

Generators, Motors and Transformers

Air-Cooled Transformers.—An article on the gradual displacement of air-cooled transformers by oil-cooled transformers. The only disadvantage of air-cooled transformers is the difficulty of securing reliable insulation, but with the present status of insulating engineering it is possible to build air-cooled transformers for voltages up to 20,000 as safe and reliable as oil-cooled transformers. The removal of the heat is reliably obtained up to ratings of 250 kva. at fifty cycles, since with proper design the natural air circulation has a sufficient cooling effect. For higher ratings artificial air circulation must be resorted to. One of the largest transformers of the General Electric Company is air-cooled and provided with artificial air circulation. It is an induction-furnace transformer of 4000 kva. at five cycles. The advantages of air-cooled transformers are easy accessibility, smaller weight and greater cleanliness. On account of the lower weight, air-cooled transformers have recently been employed on locomotives,

for instance, on the Loetschberg mountain railroad. In normal times air-cooled transformers with artificial air circulation are a little more expensive than oil transformers, but the conditions are at present reversed in Germany on account of the increased price of oil due to the war.—*Elek. Zeit.*, Sept. 2, 1915.

Ten-Thousand-Volt Direct-Current Generator.—W. Linke.—An illustrated description of a 10-kw., 10,000-volt direct-current generator used by the Reichsanstalt for experimental work. It is so constructed that either pole may be earthed or connected with the frame, while the other pole has a full voltage of 10,000 against iron. The set consists of two machines, each being a double-commutator machine, so that there are four commutators, each of 2500 volts. The armatures are normal drum armatures. The voltage between segments is not higher than in usual practice, there being 212 commutator segments. The greatest difficulty was found in the insulating of the winding, especially in the slots of the drum armature, against the full voltage of 10,000. By using the best insulating materials and by seamless covering of the winding with "micarta foil" according to the Haefely method, sufficient insulation was obtained (see diagram). The single coils were tested with 22,000 volts and the finished armature with 20,000 volts alternating current. Commutation is sparkless up to over 50 per cent overload.—*Elek. Zeit.*, Oct. 21, 1915.



Lamps and Lighting

Modern Gas-Filled Incandescent Lamps.—M. Pirani and A. R. Meyer.—The authors give a historical review of the development of modern gas-filled incandescent lamps. An outline is first given of the extended results of Langmuir. The patents for the gas-filled lamp in Europe are jointly owned by the Allgemeine Elektricitäts Gesellschaft, the German Welsbach company and the Siemens-Halske company, which sell these lamps under the names of nitra lamp, osram half-watt lamp, and wotan half-watt lamp. The use of the name half-watt lamp was originally correct, since the first nitrogen-filled lamps placed on the market were of 600 cp. or more. In more recent times these lamps have been also built for lower candle-powers, and the name half-watt lamp has had to be dropped as the specific consumption is higher. Nitrogen is used for lamps of 600 cp. and more, while argon or a mixture of argon and nitrogen is used for lower candle-powers. The advantage of argon is lower heat conductivity. But as pure argon has a relatively low dielectric strength the lamps filled with pure argon have a dangerous liability to short-circuits. It is, therefore, advantageous to use a mixture of argon and nitrogen, and this is an advantage, since commercial argon contains nitrogen. Different arrangements of the filament are described and illustrated, and photometric curves for these arrangements are given. Lamps consuming 0.55 watt per spherical candle have a filament temperature of 2500 deg. C., which is about 415 deg. higher than the filament temperature of the standard 1-watt-per-candle-power lamps and is about 90 deg. higher than that of a vacuum lamp, if the latter be operated at the same specific consumption. The development of incandescent lamps is sketched in the accompanying table. The candle-powers are hefner candles.—*Elek. Zeit.*, Sept. 23 and 30, 1915.

DATA ON DEVELOPMENT OF INCANDESCENT LAMPS

Type of Lamp	Watts per Horizontal Cp.	Watts per Spherical Cp.	Lumens per Watt
Carbon lamp	3.5	3.9	3.2
"Metallized-carbon" lamp	2.2	2.45	5.1
Nernst lamp	1.7	2.1	6.0
Osmium lamp	1.5	1.9	6.6
Tantalum lamp	1.6	2.0	6.3
1-watt-per-cp. tungsten lamp	1.1	1.35	9.3
Gas-filled tungsten lamp	.....	0.09 to 0.55	14.0 to 22.8

Installations, Systems and Appliances

Electricity Supply in Germany and the Government.—G. Siegel.—It seems certain that when the war is over the German government will undertake in some way legislation on or regulation of electricity supply throughout Germany. It may be simply a law making regulations for the prevention of accidents, etc., or a tax may be laid on the electricity supply (which the author considers would be exceedingly detrimental), or the government may decide to create a government electricity supply monopoly for the whole of Germany. The author thinks that the only thing the government could do successfully in the way of a monopoly would be to erect large generating plants at coal mines, peat deposits, etc., and connect these generating plants with each other by high-tension transmission lines, from which energy would be taken off by large transformer stations. The further distribution of the energy should, however, be left to the present central stations.—*Elek. Zeit.*, Aug. 19, 1915.

British Central Station.—Heywood, a Lancashire town of 27,000 inhabitants, about 3½ miles from Bury, England, has 617 kw. of lamp connections, 400 kw. of motor connections, and a load-factor of 22.6 per cent. Its costs per kilowatt-hour sold last year, including all charges except interest and sinking fund, were 2.14 cents. For all future extensions it has now been decided to take bulk supply from Bury. Three-phase currents at 6300 volts and fifty cycles are transmitted from Bury to Heywood over an overhead line and converted to direct current by a rotary converter which works in conjunction with a battery.—London *Elec. Eng'ing*, Nov. 11, 1915.

Electric Winding in Mines.—Phillippi.—An article on the comparatively low efficiency of electric winding installations in potash mines. The author recommends a more careful investigation of the losses in these installations and the consideration of a bonus system for low power consumption. A thesis by E. Oppenheimer shows that considerable may be accomplished in this direction.—*Elek. Zeit.*, Sept. 30, 1915.

Wires, Wiring and Conduits

Cable Compound.—A note on a recent British patent (No. 4820, 1915) of R. C. Sharp for a compound for filling cable conduits, etc., consisting of pitch or bitumen, to which is added while in the molten state finely ground and pulverized spent shale.—London *Elec. Eng'ing*, Nov. 4, 1915.

Construction of Insulators from Impregnated Paper.—K. Fischer.—An article on the construction of insulators out of "hard paper" or "pertinax," which is made by rolling on one another layers of paper impregnated with resins. The author discusses the most suitable designs of insulators from this material.—*Elek. Zeit.*, Sept. 2, 1915; translated in abstract in London *Electrician*, Nov. 12, 1915.

Iron and Bimetallic Wires.—John M. Miller.—A long paper of sixty pages on the effective resistance and inductance of iron and bimetallic wires. A formula is derived which permits the exact permeability curve of a homogeneous iron wire for circular magnetization to be obtained from measurements of the self-inductance

of the wire with direct current. The effective resistance and inductance of a number of samples of iron telegraph and telephone wires are determined by a bridge method in the range of frequencies from 50 cycles to 3000 cycles per second and with current strengths varying from 0.5 amp. to 10 amp. The experimental results are interpolated to zero current and compared with values calculated from the minimum permeabilities of the materials. Formulas are derived for the effective resistance and inductance of bimetallic wires for the case of constant permeability of the materials. A number of copper-steel bimetallic wires are investigated experimentally, and the results for low current are compared with the values obtained by computation. A table of computed values of effective resistance and inductance for various frequencies is given for copper-steel wires of 30, 40 and 50 per cent conductivity and for sizes Nos. 0, 2, 4, 6, 8, 10 and 12 A. W. G.—*Bulletin Bureau of Standards*, Vol. 12, No. 2, Nov. 8, 1915.

Electrophysics and Magnetism

Ionic Mobilities in Hydrogen and Nitrogen.—W. B. HAINES.—It has been recorded by Franck that when nitrogen, argon and helium are carefully purified there can exist in them, even at atmospheric pressure, negatively electrified particles having such high mobilities as leaves no doubt that they are free electrons. The values recorded are 120 cm./sec. for nitrogen, 206 cm./sec. for argon, and 500 cm./sec. for helium in unit field. These particles were found to be extremely sensitive to any impurity in the gases. The research which the present paper describes was undertaken to investigate in greater detail the effect of impurities in nitrogen, and the work has extended to some interesting results for hydrogen as well. The mobilities of free electrons in pure nitrogen at atmospheric pressure were measured, and the effect on them of various impurities was tested. In some cases only a minute trace of the foreign gas is required to prevent completely the appearance of the free electrons. In nearly all cases their life in the free condition, as measured by the mobility, is much reduced by small proportions of the impurity. Hydrogen is found to belong to the list of gases in which free electrons can exist at atmospheric pressure. The hydrogen must be purified with great care to obtain these results. Under these conditions other negative ions of high mobility appear, for which measurements have been made. It is interesting to note that, according to results recently published by Wellisch, the electrons appear in dry air at pressures below 10 cm.—*Philos. Magazine*, October, 1915.

Roentgen Rays.—QUAINK.—An illustrated description of the Roentgen-ray building of the St. Georg Hospital in Hamburg, Germany.—*Elek. Zeit.*, Oct. 21, 1915.

Units, Measurements and Instruments

Meters.—An illustrated description of a direct-current motor meter of the Allgemeine Elektricitäts Gesellschaft and of an oscillation direct-current motor meter of the same company which are officially admitted for calibration by the Reichsanstalt.—*Elek. Zeit.*, Sept. 30, 1915.

Meters.—An illustrated description of a direct-current magnet motor meter of Körting and Mathiesen which is admitted for official calibration by the Reichsanstalt.—*Elek. Zeit.*, Sept. 23, 1915.

Inductance Measurements.—F. WENNER, E. WEIBEL AND F. F. SILSBEE.—An account of an investigation in which two methods of measuring the inductances of low-resistance standards were tested and critically compared.—*Bulletin Bureau of Standards*, Vol. 12, No. 1, Oct. 28, 1915.

Radiation Pyrometers.—G. K. BURGESS AND P. D. FOOTE.—A ninety-page paper with many illustrations in which the authors give an account of the principles which form the basis for the operation of total radiation pyrometers, descriptions in some detail of representative types of this instrument, together with the results of an experimental study of their calibration and behavior under various conditions of use and as modified by changing the several factors which may influence the readings of such pyrometers. A considerable portion of the paper is devoted to the examination of the sources of error and their elimination or correction. In all, there were carefully examined some twenty instruments, including all the types commonly met with in practice, such as the Féry, Foster, Thwing and Brown pyrometers. The Stefan-Boltzmann law $E = a(T^4 - T_0^4)$ is not, in general, except by accident, obeyed in its exactness by any of the pyrometers examined. In general, a radiation pyrometer behaves not as a "black" or total receiver of energy but as a "gray" receiver for the ordinary range of temperatures.—*Bulletin Bureau of Standards*, Vol. 12, No. 1, Oct. 28, 1915.

Temperature Coefficient of Magnetic Permeability.—R. L. SANFORD.—An account of an investigation in which magnetic measurements at different temperature within the atmospheric range were made on a number of materials with different heat treatments. The results of these measurements are of such a nature that the following conclusions seem to be warranted: The temperature coefficient of magnetic permeability, though small, cannot be neglected in magnetic measurements of high accuracy. On account of the wide variation in temperature coefficient, not only for different materials but also for the same material with different heat treatments, correction cannot be made to standard temperature from data obtained from other materials. Unless the temperature coefficient is known for the particular material under test, temperature control offers the only means of avoiding the error due to temperature changes, at least where errors as great as 1 per cent are to be avoided. Conditions often arise in practice where the temperature of a specimen may be raised from 10 deg. to 20 deg. above the temperature of the room, owing either to a comparatively heavy current or to the use of coils already heated from a previous test. Since temperature coefficients may be as great as 0.3 per cent per degree, errors amounting to 2 per cent or more may exist. These conclusions hold in general, even though there may be materials which have very small or even zero temperature coefficients.—*Bulletin Bureau of Standards*, Vol. 12, No. 1, Oct. 28, 1915.

Testing Platinum Ware.—G. K. BURGESS AND P. D. SALE.—A description of a simple thermoelectric method suitable for the determination of the purity of platinum ware. This method does not mar the articles tested and gives data for the classification of platinum in terms of its equivalent iridium (or rhodium) content.—*Bulletin Bureau of Standards*, Vol. 12, No. 2, Nov. 8, 1915.

Telegraphy, Telephony and Signals

The Discharge Tube Used as a Wireless Valve.—G. W. WHITE.—All "gas valves" used up to the present utilize the electron emission from glowing filaments as the telephone current, this current being influenced by potential changes on a metal grid or gauze through which it must pass to the anode. The author has been successful in using the current set up when two ordinary electrodes are fixed opposite one another and maintained at a high potential difference in a rarefied gas. To obtain the necessary big current for convenient values of the potential difference a large vessel should be employed and an intermediate electrode which does not introduce much resistance. A glass tube of 20-cm. length and 5-cm. diameter was used, the cathode being an aluminum disk

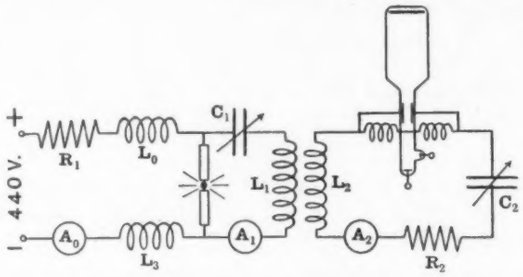
fixed 6 mm. below the intermediate electrode, which consisted of a copper disk filling the tube and provided with three holes of 1.3-cm. diameter. The nature of the anode was of little importance; an aluminum wire sufficed. The best gas pressure was such as would make the edge of the "cathode dark space" just touch the perforated plate; the valve was, however, effective if the pressure was as high as 3 mm. The conditions have not yet been determined which will yield a valve to compare in sensitiveness with the present ones employing a glowing cathode, and a higher potential (400 volts to 800 volts) is required to get the discharge in air. This potential can be considerably decreased by using the rarer gases. A valve based on this principle has two advantages: It dispenses with the filament and heating battery, and it is not sensitive to small pressure changes. It is effective only for "wireless" frequencies and would be useful where long life is essential and the value of the magnification unimportant.—London *Electrician*, Oct. 22, 1915.

Loaded Cable.—An illustrated article on the completion of the London-Birmingham loaded cable which is part of the cable to connect London with Liverpool. There are fifty-two telephone pairs in the cable along the entire route, divided as follows: Two direct circuits on 300-lb. conductors, fourteen on 200-lb. conductors, twelve on 150-lb. conductors, and twenty-four on 100-lb. conductors. In addition, twelve of the 100-lb. and all of the twelve 150-lb. circuits carry superimposed or phantom circuits (six phantom circuits in each of the two groups), and provision has been made by auxiliary stubs at the loading points for adding further phantom circuits as required. The attenuation on the different circuits was measured as follows, in good agreement with the predetermined theoretical values:

Weight per Wire per Mile, Lb.	Attenuation Constant
300 direct	0.00408
200 direct	0.00664
150 direct	0.00884
150 phantom	0.00756
100 direct	0.01092

Results of such test determination of terminal losses and cross-talk tests are added.—London *Electrician*, Oct. 29, 1915.

Undamped Electric Oscillations by Quenched Spark Dischargers.—Hidetsugu Yagi.—E. L. Chaffee has been the first to show experimentally that a practically undamped electric oscillation can be obtained by means of high-frequency quenched sparks between an aluminum cathode and a copper anode immersed in a moist hydrogen atmosphere. The writer has made some observations on the behavior of an aluminum-brass gap in an atmosphere of coal gas and has found similar results. A Braun-tube oscillograph was used for the analysis of the oscillation. The arrangement is shown diagrammatically herewith. From a storage battery of 440 volts a



CIRCUITS FOR OBTAINING UNDAMPED OSCILLATIONS FROM HIGH-FREQUENCY QUENCHED SPARKS

current of about 0.3-0.4 amp. was supplied through high resistance and large inductance. Within the range of the variable capacities C_1 and C_2, both being less than 0.003 mfd., the curve on the fluorescent screen of the tube was either a circle or an ellipse, which proves that the oscillation in the secondary circuit is virtually an undamped harmonic oscillation. When C_1 is larger, the curve when the resistance R_2 is large has a certain thickness. This shows that the oscillation is not absolutely undamped, but is slightly damped and returns to the original amplitude after every few cycles. When C_1 is increased to 0.015-0.03 mfd., the discharge becomes less frequent, and the image on the screen changes into a spiral when R_2 is increased. A series of curves is given obtained by changes in R_2 and C_2. The principal results of the investigation are stated as follows: Practically undamped oscillations may be obtained by means of impact excitation provided that the impulses are sufficiently frequent. According to the ratio of the frequency of the impulses to that of the oscillation, there is a significant fluctuation in the intensity of the oscillation. The indication of a wave-meter becomes unreliable as soon as an undamped oscillation is created in the meter circuit, or when the frequency of the impulses is sufficiently high.—London *Electrician*, Nov. 12, 1915.

Book Review

Wireless Telegraphy. By Dr. J. Zenneck. Translated from the German by A. E. Seelig. New York: McGraw-Hill Book Company, Inc. 442 pages, 467 illus. Price, $4.

Professor Zenneck's "Lehrbuch der Drahtlosen Telegraphie" is well known to be a classic on radiotelegraphic theory and practice, but the fact that it appeared in the German language made it literally a closed book to many American and English radio engineers. Now that it has been so well translated into English by Mr. Seelig, it should find a far wider but equally appreciative audience. The scope of the book is broad, running from elementary treatment of condenser and antenna circuit currents through the important measurements of the art and explanations of coupled-circuit phenomena into technical descriptions of sustained and damped-wave apparatus. Progress up to 1912 is well stated, and many students of the art will be surprised to note the clearness with which a large number of "new" phenomena were understood by Professor Zenneck at that time. Although the greatest benefit from a study of this book can be gained by the reader who is familiar with the calculus, there is in it so much intensely valuable practical matter that almost anyone interested in radio will be fully repaid for the time given to reading it. Although some of the historical statements may be questioned, the book is unqualifiedly recommended since its merits completely overshadow any disagreements in that direction. The presswork of this edition is admirable.

Books Received

The Principles of Dynamo-Electric Machinery. By Benjamin F. Bailey, B.S., Ph.D. New York: McGraw-Hill Book Company, Inc. 314 pages, 222 illus. Price, $3.

Theoretical Elements of Electrical Engineering. By Dr. Charles Proteus Steinmetz. New York: McGraw-Hill Book Company, Inc. 368 pages, 191 illus. Price, $3.

Liability for Injury to Employee of Independent Contractor.—According to the Supreme Court of Iowa (154 N.W. 317), where work is done by an independent contractor no liability exists against the other party to the contract for personal injuries to the negligent contractor's employee.

Damages from Impounded Water.—Evidence introduced to show not only that a dam caused back water actually to start on certain land but also that it had the effect of inducing a moist condition of the subsoil over a much larger area, thus preventing proper drainage and tending to lessen the land's productivity, was held by the Supreme Court of Indiana in the case of the Southern Indiana Power Company vs. Monical (109 N.E. 763) to be a proper consideration in assessing the damages.

Commission Control of Bankrupt Companies.—Receivers properly appointed by a court of competent jurisdiction in possession of and operating a public utility, it was held in the Supreme Court of Kansas, are under the control of the public utilities commission in the same manner and to the same extent as the owners of the utility would be if they were operating the utility themselves. The public utilities commission has power to fix rates for the service rendered by a public utility although that utility is being operated by receivers appointed by a court of competent jurisdiction.

Source of Tenant's Electric Power.—In the case of the People's Land & Manufacturing Company vs. Beyer, the Supreme Court of Wisconsin held (154 N.W. 382) that where the owner of realty leased to short-term tenants from month to month he had the legal right to induce such tenants to cease using the electric power of a certain company and to use that of a rival company, since such company's legal rights to sell its energy to those desiring to use it could lawfully be interfered with by the owner's equal or superior rights to lease its property only under such conditions as he might choose.

Injury to Station Operator.—A day operator in the electric plant of a railway company, relying on information given him by the night operator, attempted to clean certain portions of the station's apparatus and in so doing was killed by coming in contact with a highly charged wire which the night operator had stated was dead. The Supreme Court of Utah (151 P. 979) held that the lower court improperly excluded evidence of what the night watchman at the plant had told the decedent as to the condition of the electrical appliances when he came to work in the morning, since the decedent's widow as plaintiff had the legal right to prove that such information had a bearing upon decedent's negligence in attempting to clean certain portions of the apparatus. It was also held that the plaintiff could show within the limits of her complaint in what particulars, if any, the appliances of the plant were defective or dangerous, and was further entitled to have her experts explain to the jury why the plant was dangerous.

Legal Notes

Court Decisions and Opinions Bearing on Questions Affecting the Electrical Industry

Assumption of Risk by Emergency Lineman.—An experienced foreman of an emergency crew in charge of the electrified zone at the Hoosac Tunnel on the Boston & Maine Railroad, whose contract of employment was to repair defects in the transmission system and who knew and appreciated the manifestly dangerous work as well as his employer, assumed the risk, and the employer owed him no duty and could not be guilty of negligence, according to the Judicial Court of Massachusetts (109 N.E. 820). Where the employer is negligent in matters outside the risk assumed under the employee's contract of employment the conduct of the employee in assuming the risk is a voluntary assumption, and he cannot recover for injuries received.

Negligence Resulting from a Fallen Wire.—During a heavy windstorm some wires of the Lexington Utilities Company broke and fell. The company was notified, but the repairmen did not reach the scene until about one hour later. In the meantime one of the citizens of the town was struck by one of the live wires and killed, and the estate brought action against the company. The company lost the case and appealed to the Court of Appeals of Kentucky, which held (178 S.W. 1173) that since the company received a notice in regard to the break in the wires it was negligent in not shutting off the electricity until it ascertained that it was safe to keep it on. The utmost degree of care and skill which might be used under similar circumstances is the standard of duty imposed upon utilities.

Commission's Powers.—It was held by the Maryland Court of Appeals (P. U. R. 1915, E. 474) that a railroad company under no contractual obligation with individuals to make a certain extension is under no imperative duty to build it by virtue of a permissive charter or of its profession of service, nor is there any unrestricted and uncontrollable power in the Maryland Public Service Commission to compel such extension. The Maryland Public Service Commission is without power to order a proposed extension of an electric railway to be constructed, operated and equipped in a specified manner, where, if the work were done as the directors of the company in the fair exercise of their discretion deem proper, the line could be operated only at a loss, and where the directors deem that construction and operation in the manner specified by the commission would be unprofitable and unbusinesslike; since the method of construction, operation and equipment of such extension is a matter within the honest discretion of the directors.

Jurisdiction of Public Service Commissions.—In a decision handed down by the Maryland Court of Appeals (P. U. R. 1915, E. 812) it was held that a public service commission has jurisdiction to fix water rates, irrespective of whether the supply is furnished by a corporation or an individual. A person supplying water to buildings under an agreement to furnish a water supply "for all the buildings, in number about 100," the erection of which was contemplated, which does not restrict him to supply only those buildings, is engaged in a public service, so that a public service commission may regulate the rates, although a plant is constructed for the purpose of supplying only 100 buildings. Upon the merger of a small plant engaged in a private service, the public character of the service extends to the entire plant, so that a public service commission may regulate the rates of the former private service. Regulation of water rates is an exercise of the police power of the State, of which it cannot divest itself and which it does not abandon by nonuser. Power may be exercised by the legislature directly, or the legislature may delegate the power to a public service commission. The obligation of a contract to supply buildings with water at a specified rate is not unconstitutionally impaired by a subsequent order of a public service commission changing the rate, in the exercise of the police power delegated to it.

Elements of Valuation.—The Idaho Supreme Court (P. U. R. 1915, E. 436), in reviewing a rate decision handed down by the Idaho Public Utilities Commission, held that in ascertaining the value of a water plant for rate-making purposes the worth of a new plant of equal capacity, efficiency and durability, with proper discount for defects in the old and the accrued depreciation, should be the measure of value, rather than the cost of exact duplication. While a deduction should be made for actual, tangible depreciation in ascertaining the value for rate-making purposes, no deduction should be made for depreciation where it appears that the plant is in good operating condition and giving as good service as a new plant. In the absence of evidence tending to show that expense has been incurred in building up the business, no separate allowance should be made on account of the plant being a going concern in ascertaining its value for rate-making purposes, but that fact should be considered in estimating the value of the physical property and assets. An allowance should be made for office furniture, horses, wagons, tools, materials on hand, and the cost of improving ground around reservoir, in ascertaining the value of the plant for rate-making purposes, where such items represent an investment reasonably necessary to the successful carrying on of the business and the rendering of service to the public. An order directing an extension and enlargement of a water plant is unreasonable where it does not appear that the company has a valid existing franchise from the city to furnish such service.

Men of the Industry

Changes in Personnel and Position—Biographical Notes

Charles A. Stone, who has been announced as the president of the American International Corporation to promote foreign trade, is one of the two original members of the firm of Stone & Webster of Boston, Mass., and is one of the most widely known men in the public-utility field. Mr. Stone was born at Newton, Mass., in 1867 and was graduated from the Massachusetts Institute of Technology at Boston in 1888, his partner, Edwin S. Webster, being a classmate. Soon after graduation both realized that there was a small, assured field for the consulting electrical engineer, with great possibilities for the technically trained man capable of appreciating business problems, and in 1889 the firm was formed with offices at 4 Post Office Square, Boston, a location close to the financial district. The firm began in a quiet way to lay out wiring, design small plants, calibrate instruments and conduct tests. A small laboratory was soon started as an auxiliary department, with quarters in Fort Hill Square, and a Stone & Webster calibration certificate soon became a recognized standard of merit. In 1891 the firm was retained by S. D. Warren & Company, Westbrook, Me., to lay out a system of electric power transmission for the famous Cumberland Mills. In the early nineties the firm engineered the construction of several generating plants of considerable size in Massachusetts, Pennsylvania and Tennessee. The unsettled financial conditions of this period opened the way for the development of advisory relations with clients in connection with the reorganization, financing, organization and operation of central-station and traction properties until the administration of properties became one of the most important functions of the organization, leading logically to the modern banking phases of the firm's work. Mr. Stone's activities have been so closely interwoven with the development of the firm that no separate consideration seems possible. He is a director in numerous public utilities in different parts of the country, about two score corporations now being under Stone & Webster management, and is a director of the First National Bank of Boston, the Old Colony Trust Company of Boston, a member of the executive committee of the corporation of the Massachusetts Institute of Technology, a member of the American Academy of Political and Social Science and other organizations.

C. A. STONE

John A. Adams has been appointed superintendent of lighting of the Pensacola Electric Company, Pensacola, Fla.

Henry I. Harriman, president of the Connecticut River Transmission Company, Boston, Mass., has been elected vice-president of the Boston Chamber of Commerce.

James Orr, chief engineer of the Tampa (Fla.) Electric Company, is now in Ponce, Porto Rico, where he will superintend the construction of a new oil-burning power station.

E. G. Howard has resigned as manager of the St. Cloud (Minn.) Public Service Company and has returned to the apparatus division of the General Electric Company, with headquarters at Minneapolis.

J. M. Kingsbury has opened an office as consulting engineer at 101 Park Avenue, New York City. Mr. Kingsbury is the secretary-treasurer of the Kingsbury Gas & Electric Motor Car Company of Great Falls, Mont.

Charles R. Underhill, chief electrical engineer of the Acme Wire Company, New Haven, Conn., has completed his second lecture tour among Middle West educational institutions this season, having lectured on the subject of electromagnets at Purdue University, the University of Illinois, the Ohio State University, the Case School of Applied Science and the University of Cincinnati.

Francisco V. Aguilera, general manager of the Manzanillo Light & Power Company, Manzanillo, Cuba, is in the United States on a four months' visit, having spent much of the time at the San Francisco Exposition. Mr. Aguilera had planned to make a trip to Japan, but owing to difficulties in obtaining passports has given up the trip. Mr. Aguilera is a graduate of Rose Polytechnic Institute, class of 1903.

J. S. Pevear, president of the Birmingham (Ala.) Railway, Light & Power Company, a subsidiary of the American Cities Company, whose time has been largely engaged in connection with the administration of the United Gas & Electric Engineering Corporation at 61 Broadway, New York City, took active charge of the Birmingham property Dec. 1. J. P. H. De Windt will remain with the Birmingham property as vice-president and general manager.

Charles O. Lenz, consulting engineer, will move his engineering offices, Jan. 1, from 71 Broadway, New York City, to the new Equitable Building, 120 Broadway. Mr. Lenz is chief engineer for the Georgia Railway & Power Company, Atlanta, Ga., the Virginia Power Company, Charleston, W. Va., and the Panama-American Corporation, Panama City, Canal Zone.

Obituary

Robert W. Kiple, who had become commercial manager of the Harrisburg Light & Power Company, Harrisburg, Pa., only three weeks before, died at his home at Harrisburg, Nov. 19, from pleuropneumonia. He was forty years old. Mr. Kiple had been connected with the electrical industry in New York State and eastern Pennsylvania since 1893. In 1904 he became manager of the Wayne County Electric Company, with headquarters at Lyons, N. Y., and in 1911 he joined the Meikelham & Dinsmore forces in charge of the Sayre (Pa.) Electric Company. He was afterward promoted to the position of general manager of the Pennsylvania Utilities Company, operating from Easton, Pa., in which capacity he remained until June, 1915, when the properties were acquired by W. S. Barstow & Company, and Mr. Kiple came to Harrisburg.

James I. Ayer, manager of the Simplex Electric Heating Company of Cambridge, Mass., and president of the National Electric Light Association in 1893, died suddenly at his residence in Cambridge on Nov. 26. Mr. Ayer was at his desk at the plant on the day of his death. He was born at Medford, Mass., sixty-one years ago and early in life became interested in science and electrical engineering. He installed the municipal lighting plant at St. Louis, Mo., which at the time was the largest of its kind in the country. For a number of years Mr. Ayer practiced electrical engineering in the Middle West. His most notable work, however, was associated with the development of the electric-heating industry, in which he was an acknowledged leader and authority, both in domestic and industrial applications. Mr. Ayer was a member of the American Institute of Electrical Engineers, the Engineers' Club of Boston and other organizations.

J. I. AYER

New Apparatus and Appliances

A Record of Latest Developments and Improvements in Manufacturers' Products Used in the Electrical Industry

The Modern Electrical Piano a Triumph of Musical Expression

The development of electrically operated pianos has opened an attractive opportunity for the exploitation of electric service. Although, of course, no great increase in the use of electrical energy is to be anticipated directly as a consequence of this development, the indirect benefits of one more application of electricity in the household—and particularly one which is so close to the home life of the entire family—must not be overlooked. Central-station interests are, therefore, not losing sight of the electric piano as a means of widening the use of electrical energy. Many companies have installed electric pianos in their display rooms and are receiving the co-operation of piano manufacturers in the demonstration of the instruments.

Recently representatives of the National Piano Manufacturers' Association and members of the merchandising committee of the Commercial Section of the N. E. L. A. conferred to discuss methods of furthering the use of electric player-pianos. A number of electric pianos will be operated for the benefit of the members of the above-named committee when it meets in New York on Dec. 10. Artists will be present at this meeting, and members of the committee will have an opportunity to hear the rendition of well-known works by electricity and by hand. The instruments will also be utilized to accompany violinists and singers and an electrically operated graphonola. The committee session will take place in the afternoon, but in the evening a number of these instruments will be operated before the meeting of the New York Electrical Society, in the Engineering Societies Building, which will be open to the public.

As the result of numerous refinements and improvements in electrically operated pianos and their auxiliary apparatus, great artistic possibilities have been opened up, placing the modern electric instrument far ahead of the ordinary foot-pedal player in both artistic expression and convenience of operation, and, of course, in an entirely different class from the early electric pianos. Delicacy of expression, uniformity in tempo and rhythm, and fidelity in shading possible with no other mechanical player, can be attained by the latest electric pianos when the hand-played rolls of master performers are used. The instruments are especially well adapted for use in accompaniment work. Moreover, where volume and carrying power are required, as in auditoriums or dance halls, two or more electric pianos may be operated in synchronism.

The latest electrically operated pianos or accessories may be divided into three groups, the first two of these groups including auxiliary apparatus which may be attached to play ordinary pianos already in use, and the third including the so-called electrically driven player-pianos. Of the two types of electric apparatus for pianos already in use, one is exemplified by the "Telektra," shown in Figs. 1 and 3, in which the control mechanism and rolls are inclosed in a separate cabinet (Fig. 3), which may be placed at a distance from the piano itself, and the second by the "Flexotone-Electrelle," illustrated in Fig. 2. This auxiliary apparatus often proves especially attractive to persons who are attached to their own pianos for sentimental reasons. The motor for operating an "Autopiano Electric," which is of the player-piano type, belonging to the third group as above classified, is illustrated in Fig. 4.

The "Telektra" consists of two parts, the player itself, or transmitter, and a small box containing a bank of electromagnets attached to the under side of the piano keyboard, each of the magnets operating a single key. The bank of electromagnets is connected with the transmitter by a light cable, which may be of any desired length. Energy is taken from an ordinary lighting socket and is utilized to operate an 0.25-hp. motor-generator set, which delivers the 14-volt direct current used for control purposes. The music rolls used in the transmitter are of brass. Eighty-eight fingers, corresponding to the eighty-eight keys of the piano, rest on this brass roll. When the tip of a finger falls in a slot of the roll it trips and closes the circuit to the corresponding magnet, energizing the magnet and causing it to pull down the key. Twelve other fingers are utilized for controlling the expression. Magnets are also employed for controlling the pedals. The "Telektra" is made by the Tel-Electric Company, 12 West Thirty-third Street, New York.

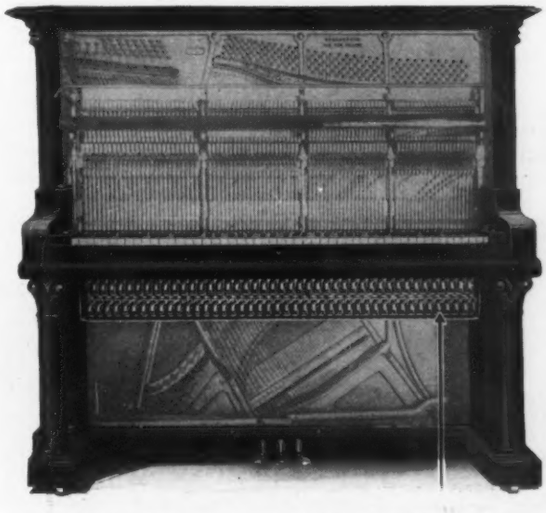


FIG. 1—PIANO WITH BANK OF MAGNETS BENEATH KEYBOARD —OPERATED FROM ROLL IN SEPARATE CABINET

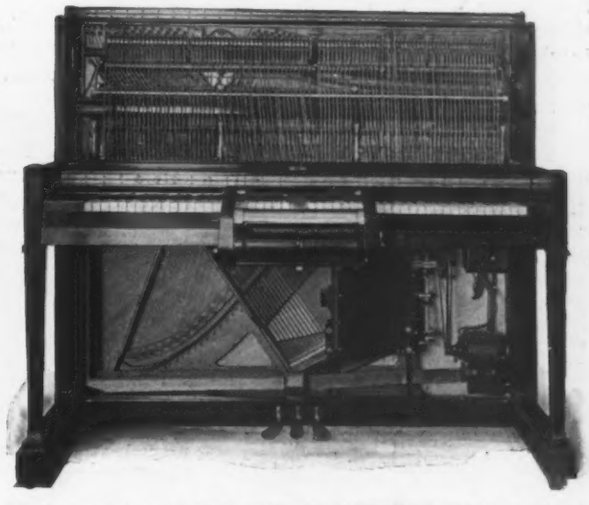


FIG. 2—PIANO OPERATED BY SUCTION BLOWER AND BANK OF MAGNETS

The "Flexotone-Electrelle" has been brought out by the American Piano Company, Fifth Avenue and Thirty-ninth Street, New York. The apparatus consists of a suction blower operated by a 1/30-hp. motor, a tracker bar over which the music roll passes, and a bank of magnets which are attached to cork shoes resting on a revolving shaft. In the tracker bar are

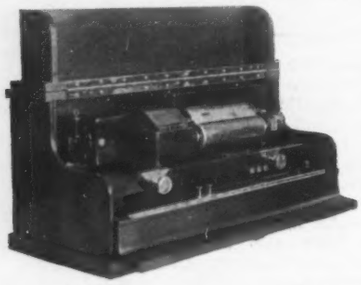


FIG. 3—METAL ROLL IN SEPARATE CABINET

eighty-eight holes, each of which controls one of the keys of the piano. Inside the tracker bar is a series of silver fingers which are brought into contact with silver-tipped screws whenever perforations in the music roll pass over the holes in the tracker bar, admitting currents of air which force the silver fingers against the silver-tipped screws. These pneumatic impulses close the circuits and energize the magnets, which in turn cause the cork shoes to come in contact with the revolving shaft. The shoes are kicked out and they pull the tapes which are connected to the whippens and throw the hammers against the piano wires. Expression is controlled by means of a flexible rail divided into four sections upon which the hammers rest. Keys are provided to control this rail in such a way that the distance between the hammers and the strings can be instantly changed, not only on the whole keyboard, but also on any part of the keyboard. The speed of the roll is controlled by means of a friction clutch.

The "Autopiano Electric," which is an instrument of the player type, is operated by a universal 110-volt motor, which propels a bellows feeder concealed within the player. The instrument is equipped with a safety valve, making over-pressure impossible. A special accenting lever called the "dynatone" makes possible all tonal contrasts, the manufacturer declares, and covers a wide range of dynamic effects. An automatic re-roll, automatic motor stop and automatic re-play device form part of the equipment. Player treadles are also provided, so that the instrument may be used where there are no electric circuits. The manufacturer points out that the "Autopiano Electric" really comprises four instruments in one—a piano, a player with treadles, a player without treadles,

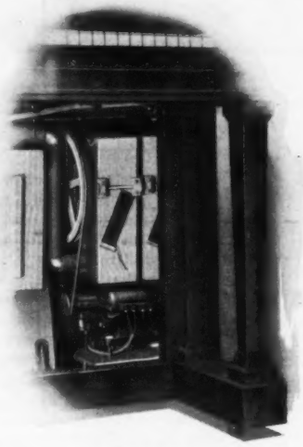
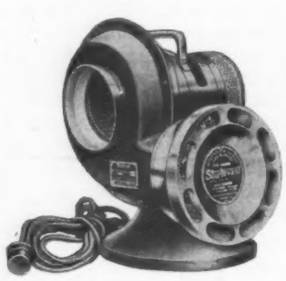


FIG. 4—MOTOR FOR OPERATING PLAYER-PIANO

and a "self-operating" instrument. Ordinary eighty-eight-note rolls may be employed with this player-piano, which is being made by the Autopiano Company, Twelfth Avenue and Fifty-first Street, New York.

Electric Air Heater and Blower

A compact portable air heater and blower, which consists of a motor-driven fan that discharges air through heating coils placed in an aluminum casing, delivering warm air at one, two or three temperatures, depending on the size of the unit, has been developed by the B. F. Sturtevant Company, Hyde Park, Boston, Mass. The fan outlet can be placed so that the air is blown horizontally as shown in Fig. 1, or can be turned upward as shown in Fig. 2, so that the air can be discharged in any direction desired. The fan consists of a sheet-iron casing in which runs a multi-vane wheel. The inside of the aluminum casing in which are placed the heating coils is so shaped that it acts as a diffuser, and the air passages are designed to be of such size that they offer little resistance to the current of air from the fan. The heating coils are of high-grade resistance wire, wound on heat-resisting insulating tubes. The electric circuit is so arranged that the heater cannot be put in circuit without first connecting the motor, thereby protecting the coils from excessive current. The device is being made in five different sizes, the first of which operates at one heat and takes 1000 watts, the second at two heats and takes 1000 watts or 2000 watts, the third at two heats and takes 2000 watts or 4000 watts, the fourth at three heats and takes 2300 watts, 4600 watts or 7000 watts, and the fifth at three heats and takes 3300 watts, 6650 watts or 10,000 watts. The volume of air produced is 90 cu. ft., 180 cu. ft., 400 cu. ft., 600 cu. ft. and 980 cu. ft. respectively. The outside diameter of the inlet is 4.125 in., 5.125 in., 6.125 in., 8.625 in. and 11.25 in. respectively, and the height is 12 in., 15 in., 19 in., 23 in. and 28.5 in. respectively. In Fig. 3 is shown a method of utilizing the heater in the bathroom, and in Fig. 4 its utilization for warming an automobile radiator. The machine is also well adapted for drying purposes and for ventilating with or without the heater in the circuit. Owing to its variety of adjustments the manufacturer claims for it an unusual degree of versatility for household and other purposes.



FIGS. 1 AND 2—ELECTRIC AIR HEATER AND BLOWER WITH OUTLET IN HORIZONTAL POSITION AND AT AN ANGLE FROM THE HORIZONTAL

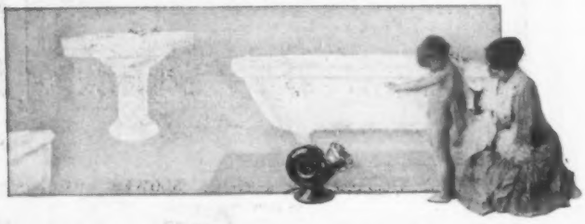


FIG. 3—AIR HEATER AND BLOWER USED IN BATHROOM

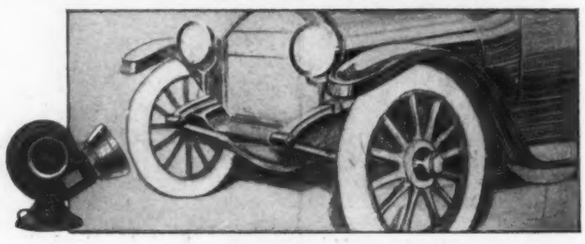


FIG. 4—HEATER WARMING AUTOMOBILE RADIATOR

Small Dynamometer

In the accompanying illustration is shown a small electric dynamometer which is especially adapted for testing motorcycle engines, small pumps, blowers, and various types of small machinery on which the manufacturer wishes to keep accurate test records. The

ELECTRIC DYNAMOMETER FOR TESTING SMALL APPARATUS

dynamometer consists of a generator with a steel frame and operates at speeds up to and including 5000 r.p.m. Speed adjustments are obtained by field control. The frame of the dynamometer is equipped with arms with distance carefully laid out from the center line of the shaft. With the device shown it is necessary only to read the speed in r.p.m. from a tachometer and the weight in pounds from a standard scale in order to determine the horsepower developed by the engine at the time of reading. No electrical readings are necessary, and the efficiency of the dynamometer does not enter into the calculations. The dynamometer is being made by the Diehl Manufacturing Company, Elizabeth, N. J.

Electrically Lighted Shaving Mirror

A compact portable mirror with electric lamp and special reflector attachment is being placed on the market by the Federal Sign System (Electric), Chicago, Ill., and is designed to throw the light on the face just below the eyes, no light being reflected into the eyes or into the mirror to interfere with vision. The reflector is cylindrical in shape and is equipped with a frosted tubular lamp, the rays from which are reflected through a narrow opening which can be adjusted to reflect the light at the exact angle desired. The mirror is of the French bevel-plate type and is mounted in a solid heavily

SHAVING MIRROR LIGHTED BY TUBULAR LAMP IN CYLINDRICAL REFLECTOR

nickeled metal back, which is provided with folding adjustable legs so that it can be placed at any desired angle or can be hung on a hook, knob or other projection on the wall. A 6-ft. silk lamp cord and swivel plug is provided so that it can be connected to an ordinary lighting socket. The device can be compactly folded for packing and is especially well adapted for travelers.

Electric Toaster and Heater

Two types of electrically operated toasters and heaters placed on the market by the Lincoln Electric Works, 112 West Adams Street, Chicago, Ill., are shown herewith. Both devices are of composition material, which prevents the heat from escaping and which the

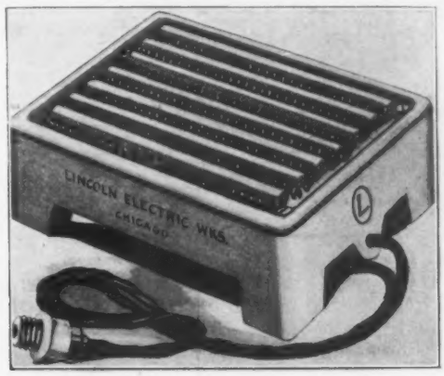


FIG. 1—COMPOSITION-MATERIAL TOASTER AND HEATER

manufacturer claims does not deteriorate or tarnish. The square toaster shown in Fig. 1 measures 6 in. by 6.5 in. by 2.5 in. and is provided with 6 ft. of heater cord and a spring plug. The round toaster may be pro-

FIG. 2—ROUND TOASTER WITHOUT TOP PLATE

vided with a top plate if desired, so that it can be utilized as a hot-plate or small stove. It is 6 in. in diameter and 2.5 in. high. In color the device is an oyster-shell pink. The top plate is finished in copper.

Electric Curling Iron

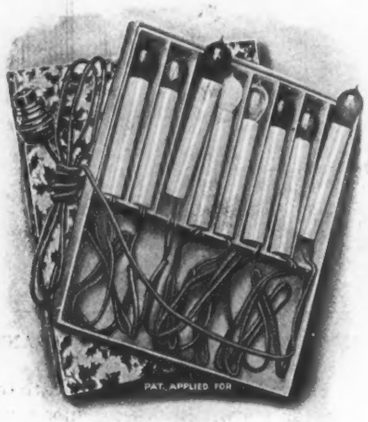
An electrically operated curling iron which is inclosed in a satin-lined carrying case is being placed on the market by the Hamilton-Beach Manufacturing Company, Racine, Wis. It operates on either alternating

ELECTRICALLY OPERATED CURLING IRON

current or direct current and is designed to furnish an even and uniform heat. The self-contained heating unit is designed to distribute equally the heat to both sides of the iron. The rounded edges of the grooved side of the curling iron prevent all possibility, the manufacturer claims, of breaking the hair. The device is finished in highly polished heavy nickel.

Electric Christmas-Tree-Lighting Outfits

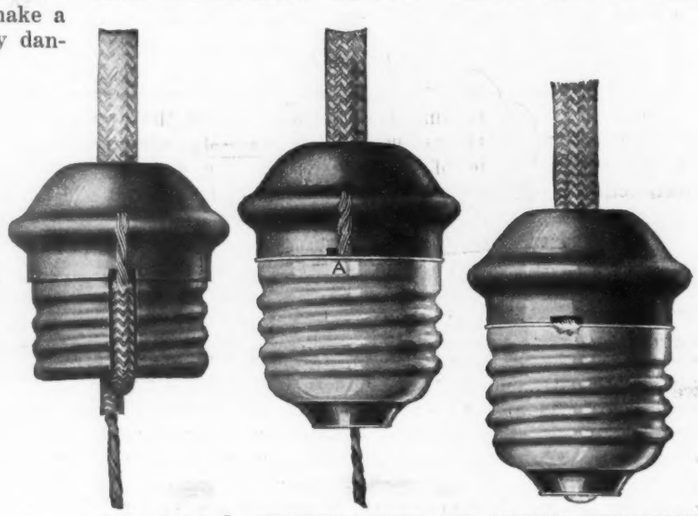
An outfit consisting of eight electric candles of various colors, for decorating Christmas trees, is being placed on the market by the Import Sales Company, 19 East Twenty-first Street, New York. The lamps with the necessary cord are packed in a decorated box as shown herewith. Electric candles of the type shown make a safe and satisfactory substitute for the ordinary dangerous wax and tallow candles. The company has also brought out outfits of sixteen lamps, twenty-four lamps and thirty-two lamps for series operation on 100-volt to 120-volt current and an eight-lamp set for operation on three dry cells.



CHRISTMAS-TREE ELECTRIC-CANDLE SET PACKED IN DECORATED BOX

Non-Swivel Attachment Plug

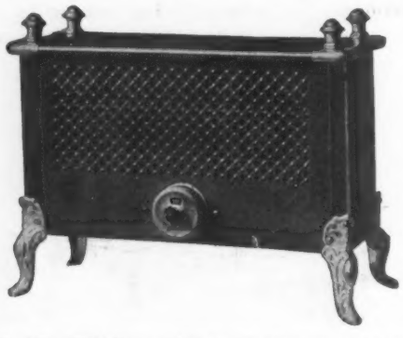
An attachment plug which can be quickly and easily connected and which is designed to withstand considerable strain on its terminals is being placed on the market by R. S. Mueller, 423 High Avenue, Cleveland, Ohio. After the insulation has been removed from the wire terminals, the ends are placed in the position shown in Fig. 1. The brass shell is then screwed on the plug, so that one wire will go through the hole in the round disk at the end of the brass shell and the other will protrude from the slot in the side of the plug, as indicated in Fig. 2. The connection is completed by clinching the brass shell to a plug with a suitable tool at the point marked *A* in Fig. 2, and each wire is soldered to the place of contact on the brass shell. The plug properly connected ready for service is shown in Fig. 3.



FIGS. 1 TO 3—SHOWING FIRST AND SECOND OPERATIONS IN CONNECTING TERMINALS, AND COMPLETE PLUG

Electric Air Heater

In the accompanying illustration is shown one of several types of new electric air heaters recently developed by the Westinghouse Electric & Manufacturing Company, East Pittsburgh, Pa. The heating element is steel-clad and is insulated with mica. It is fully protected from both electrical and mechanical injury and is designed to heat by circulating the air instead of by radiation from red-hot coils. The frame is made of polished Russia iron with polished-aluminum trimmings and feet, making the heater light, so that it can easily be carried from place to place. A three-heat indicating snap switch is provided as shown in the illustration. The heater is being made in three sizes with ratings of 1000 watts, 2000 watts and 3000 watts on high heat, 500 watts, 1000 watts and 1500 watts on medium heat, and 250 watts, 500 watts and 750 watts on low heat respectively. The weight of the different types is 7 lb., 10.5 lb. and 14 lb. respectively.



ELECTRIC AIR HEATER WITH THREE-HEAT INDICATING SNAP SWITCH

Handy Battery-Operated Lantern

A small electric lantern which is similar in shape to an ordinary oil-burning lantern has been developed by the Hartford Electric Novelty Company, 160 North Fifth Avenue, Chicago, Ill. The device is 6.5 in. high and is equipped with a 5-in. bail handle. The glass globe is 4 in. high and is 2.5 in. in diameter at its widest part. The small tungsten lamp is operated by a three-cell "Mars" battery, which is inclosed in the base, the latter being 2 in. high and 3.75 in. in diameter. The circuit is closed by turning the screw shown in the base. The lantern is adapted for many uses about the farm and home and can be employed by automobilists.

ELECTRIC HAND LANTERN

Electrically Operated Refrigerating Machine

The compressor, condenser, oil trap and receiver of the ammonia-compression refrigerating machine shown herewith are inclosed in one single-piece casting. Most of the joints subjected to high pressure are within the casting, and therefore the danger from leaks has been reduced to a minimum. Besides being a compact unit, the compressor is valveless. The lubrication of the machine is automatic, and the oil reservoirs have to be refilled every three or four months. Sediment traps are provided, and the stuffing box is so designed that no difficulties present themselves in the way of ammonia leaks. Use is made of an expansion valve which is designed to be set for a certain pressure and will maintain that pressure irrespective of the speed of the machine or temperature in the refrigerator. The unit can be placed in the basement or on any other floor of a building and can be connected to either one refrigerating box or half a dozen boxes. It may also be easily disconnected and moved from place to place. The piping is extra heavy and is made into continuous coils with welded joints wherever possible. Each pressure gage is provided with a valve so as to enable the operator to

AMMONIA-COMPRESSION REFRIGERATING UNIT CONNECTED TO ICE BOX

remove it without loss of ammonia when repairing or adjusting it. The refrigerating unit is finished in dull black and is being made by the Standard Iron Works, 212 South Charles Street, Belleville, Ill.

Electric Glue Heater and Warmer

An electric glue heater and warmer which is built on the fireless-cooker principle with a heat-retaining jacket has recently been placed on the market by the International Electric Company, Indianapolis, Ind. The glue pot is designed to operate without using water. The container is made of heavy-spun copper, is portable, and may be connected to any lamp socket. A cover is provided to prevent evaporation and the formation of any skin or scum on the surface of the glue. Three degrees of heat are provided, and the current is controlled by a three-heat, dirt-proof and moisture-proof rotary snap switch which indicates the various heats—high, medium and low. High heat is utilized for melting only and will melt glue and bring it to the correct temperature, the manufacturer claims, in twenty-five minutes. The medium-heat connection is utilized only when the glue pot is in use with the cover opened for a considerable length of time. When the low-heat circuit is connected, the glue can be kept at an even temperature of about 145 deg., it is declared, when the cover is closed. The heaters are being made in various sizes with capacities of 50 gal. and less. The larger sizes are equipped with

THREE-HEAT ELECTRICALLY OPERATED GLUE HEATER AND WARMER

automatic temperature regulators which maintain the correct temperature by automatically placing the heat "on" and "off" as the temperature is decreased or increased.

The 1-quart glue heater takes 156 watts on high heat, 42 watts on medium heat and 30 watts on low heat; the 2-quart heater 330 watts on high heat, 55 watts on medium heat and 44 watts on low heat, and the 4-quart heater 440 watts on high heat, 100 watts on medium and 66 watts on low heat.

Toy Transformer

Several improvements have been introduced in the "master" type of toy transformer built by the Dongan Electric Manufacturing Company, Detroit, Mich. The device is equipped with six binding posts and a lever for controlling the secondary voltage. By means of the binding posts circuits with fixed voltages for lamps or motors requiring uniform speed are provided, and at the same time variable voltage can be obtained by means of the lever-controlled regulator for use with variable-speed toys, such as trains, etc. Low-voltage 8-amp.

TOY TRANSFORMER WITH FIXED AND VARIABLE SECONDARY VOLTAGES

fuses of the glass type are employed with the transformer. The device is rated at 150 watts, and it has a secondary-voltage range of from 6 volts to 30 volts. The primary coil is wound for either 110 volts or 220 volts and twenty-five-cycle and sixty-cycle currents. The device measures 5 in. by 5 in. by 3.25 and weighs 7 lb.

News of the Industry

A Review of Activities in the Electrical Manufacturing, Selling and Central-Station Fields

INDUSTRIAL ELECTRIC HEATING GAINS

Convention of Association in Detroit Reveals Big Strides Made During the Past Year

In opening the second convention of the Industrial Electric Heating Association at the Statler Hotel in Detroit, Nov. 26 and 27, A. K. Young of Toledo, president of the association, said: "Since our first meeting a little more than a year ago the members of this association have closed contracts for industrial electric heating aggregating 100,000 hp." Other statements equally gratifying in nature came from the sales managers of three great electric-service companies—the Commonwealth Edison Company of Chicago, H. L. Doherty & Company of New York, and the Cleveland (Ohio) Electric Illuminating Company. E. W. Lloyd of the Commonwealth Edison Company said he had heard from a good authority that more electric steel furnaces had been sold in the United States in the last six months than in the preceding five years. George Williams of the Doherty company said that the members of the association had accomplished more in the last year than any other group of new-business men. M. E. Turner of the Cleveland company declared that since attending this convention he was convinced that the industrial electric-heating loads which central stations would develop in the future would make former load developments which seemed large sink into insignificance.

The convention program was arranged so that about half of the time was given over to indoor sessions and half was devoted to trips of inspection to some of the industrial plants using electric service for heating. At Detroit, as was brought out by these trips, electric heating—or electric japanning and enameling, to be more exact—is not confined to the automobile industry but has already extended to the adding-machine industry, the gas-stove industry, the fuse-box industry, the miscellaneous-piece industry and other industries. Two of the plants visited were the Detroit Stove Works and the Barney Nehls Company. Photographs of the ovens installed by the Young Brothers Company of Detroit at the latter plant are reproduced herewith. A proposed trip to the factory of the Dodge Brothers Motor Car Company, where a battery of ovens contains heaters rated at 3200 kw., had to be given up because the necessity for rushing production at the Dodge plant makes it imperative that no visitors be admitted.

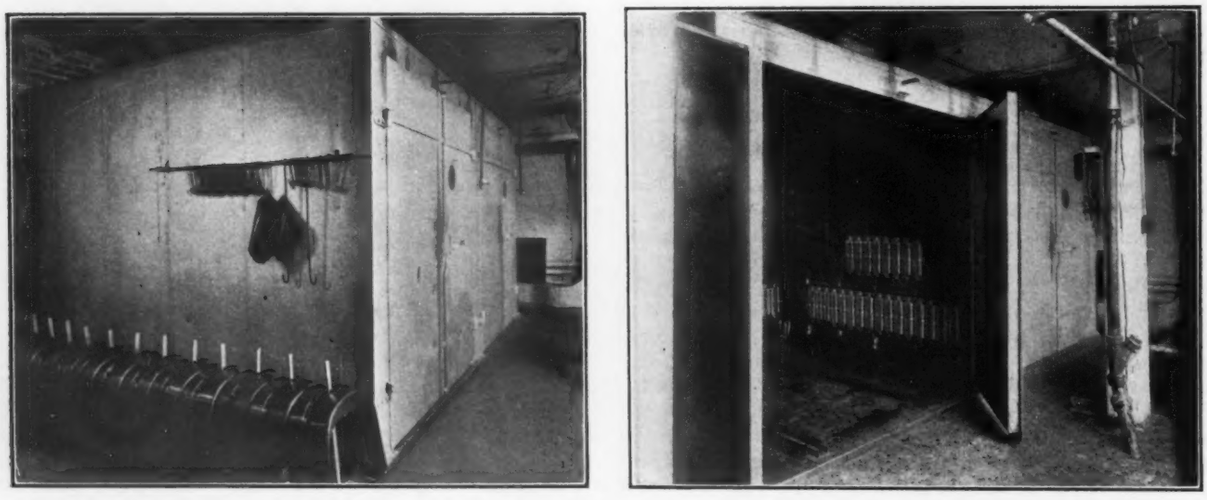
Experience with Industrial Heating

At the indoor meetings several papers were read and several impromptu talks relating experiences and practices in industrial heating were given. The first paper, by H. J. Kunz of Toledo, gave practically the same data as were published in an article on the Overland company's installation in the ELECTRICAL WORLD of June 26, 1915. Mr. Kunz also described a new continuous-conveyor oven which is installed at the Overland plant. Work ready to enter this oven is hung on a continuously moving chain, is carried through a preheating chamber, the travel in this room requiring one hour, is dipped into a tank of japan or varnish, is carried over a draining pan, and is then taken into the main oven chamber, where it remains traveling on the chain for six hours.

J. A. Seede of Schenectady was not present to give his paper on "Progress in Aluminum and Brass Melting," but C. W. Bartlette of the General Electric Company said that within a month his company expected to place in operation in its own foundry an alternating-current coke-resistor type, 500-lb. brass-melting furnace. A furnace of the same size for melting aluminum is now in operation at the company's shops and is said to be giving better results than the gas-fired or oil-fired furnace.

In reply to a question regarding comparative fuel costs for electric and gas-operated furnaces, H. O. Lobelle of Toledo, Ohio, said that electricity at 1 cent per kilowatt-hour would compare favorably with artificial gas at 25 cents per 1000 cu. ft.

Prof. C. F. Hirshfeld of Detroit emphasized the fact that central-station men in writing for information to help solve their heating problems should give complete



EXTERIOR AND INTERIOR OF ELECTRIC JAPANNING OVEN IN THE PLANT OF THE BARNEY NEHLS COMPANY, A MANUFACTURER OF AUTOMOBILE PARTS, DETROIT. NOTE HEATING ELEMENTS IN VIEW AT RIGHT

data regarding the installation contemplated. They should state, he said, the size of oven, cycle of heating or baking operation, necessary temperature, weight of material to be baked, how material is handled, duration of baking process, outside temperature of present oven if one is used, weight of trucks carrying material into oven if trucks are used, and the number of bakes required to produce a finished product.

Getting back to the electric melting furnace again, Mr. Crosby of Detroit said that while the cost of producing ordinary crucible steel varies from $45 to $60 a ton, electric steel of like quality is being made in Detroit for prices ranging from $25 to $27 a ton. Ordinary converter steel costs range from $35 to $40 a ton, but with the electric furnace a like steel is being produced for $20 to $23 a ton. Ordinary open-hearth and a comparable electric steel can both be made for $19 to $25 a ton. It has been found at Detroit that the heating cost in steel-melting furnaces is higher for electricity than for gas, but the lower raw-material cost and lower labor cost incident to the electric process make it less expensive in the long run.

Power Requirements for Japanning Ovens

Prof. C. F. Hirshfeld's contributions to the convention were highly instructive. They consisted of preliminary reports on results produced by baking japan with electricity and with gas, and on power requirements for japanning ovens. In presenting these reports, Professor Hirshfeld explained that they were still incomplete, and for that reason would not be given out for publication at this time. It may be said, however, that microphotographic studies are being made of japanned surfaces produced by gas and by electric ovens. Even to the layman the different results shown by the prints are very interesting. With the assistance of Mr. Carter of the Detroit Edison Company, Professor Hirshfeld has also worked out a reasonably accurate method for figuring the power requirements of japanning ovens. It is not the idea of the Detroit Edison Company to keep this information from interested central-station men, but to prevent its wrongful use by other interests.

At the close of the first day's session E. W. Lloyd, president of the National Electric Lighting Association, extended an invitation to the Industrial Electric Heating Association to affiliate itself with the former body. He suggested that the heating association might become a bureau of the Commercial Section of the National Electric Lighting Association and operate in a manner similar to the present power bureau. Mr. Lloyd's suggestion was embodied in a motion which passed unanimously. The heating association's executive committee, of which H. O. Lobelle of Toledo is chairman, was then instructed to formulate plans for the affiliation.

Other papers and talks on the program were: "Electric Welding," by E. S. Zuck of East Pittsburgh, Pa., read by Frank Thornton of East Pittsburgh; "Origin of Electrically Heated Japanning Ovens," by W. Dygert of the Detroit Edison Company, and "Japans and Enamels," by Mr. Donahue of the Van Camp-Donahue Company.

Los Angeles Condemnation Valuation First Hearing

Commissioner E. O. Edgerton of the Railroad Commission of California heard on Nov. 22 at Los Angeles preliminary arguments in the matter of determining a valuation on the plant of the Southern California Edison Company within the city of Los Angeles, which the municipality has proposed to acquire through condemnation proceedings for the distribution of power derived from the Aqueduct development. The city, assuming the position that it could acquire the distribution system and leave the Edison company in possession of transmission lines passing through the city but serving exterior territory, started to offer testimony tending to separate the lines it wished included in the appraisal from the other ones. This testimony was interrupted by the interposition by the Edison company of a question relating to its franchises. The company claims, in substance, that if the transmission lines are left in its hands this must be done under existing franchises, which, as the courts have held, impose upon the holder the duty of serving any premises in the city applying for service; while if the franchises are taken over this will involve rebuilding a new transmission system, belting the city, at a large cost, which must be included in the compensation to be paid by the city. After hearing arguments the commissioner adjourned the hearing until Dec. 13, when a ruling will be made on this preliminary point which will permit the further presentation of the case. Assisting R. H. Ballard of the Edison company are Dr. George L. Hoxie and Halbert P. Gillette, New York; Arthur R. Kelley of San Francisco, and J. E. Barker of Los Angeles. Engineer E. F. Scattergood is assisting W. B. Mathews, special counsel for the city.

Electrification of Chicago Railroad Terminals Declared Financially Impracticable

The complete electrification of the Chicago Railroad terminals as a means of reducing smoke is, according to the report of the Chicago Association of Commerce's committee of investigation on smoke abatement and electrification of railway terminals, which after four and one-half years of work was formally delivered to the association on Dec. 1, technically practicable but financially impracticable. The committee finds that the minimum cost of electrification to bring about smoke abatement would be $178,127,230. Added to this would be $96,313,400 for betterments and rearrangement of yards and other properties to meet new operating conditions, which would make the cost $274,440,630.

Steam locomotives cause only a fraction of the damaging smoke. High-pressure steam plants were found to produce 44.49 per cent of all visible smoke emitted within the city limits; metallurgical and other manufacturing furnaces produce 28.63 per cent; steam locomotives 22.06 per cent, and domestic fires 3.93 per cent. Of the total solids in smoke, metallurgical and similar furnaces are guilty of contributing 64.26 per cent, high-pressure steam plants 19.34 per cent, domestic fires 8.60 per cent, and steam locomotives 7.47 per cent. Of the total gaseous pollution of the air, 44.96 per cent is due to high-pressure steam plants, 23 per cent to domestic fires, 21.13 per cent to metallurgical and other furnaces, and 10.31 per cent to steam locomotives. Domestic fires, including furnaces in apartment buildings, produce 57 per cent of all the soot or tarry products of combustion discharged into the atmosphere of Chicago, and for this reason constitute the most objectionable source of atmospheric pollution in the city.

Electrification of the railroads would reduce the total amount of visible smoke in the city and its immediate environs only 20.17 per cent, the total gaseous pollution only 5 per cent, and the total solid pollution less than 4 per cent. Chicago, the committee finds, burns more coal per capita than any other large city, the figure being 8.3 tons as compared with 5 tons for Cleveland, 4 tons each for Manchester and Leeds, England; 3 tons for Hamburg, Germany; 2 tons for Paris, France, and 1½ tons for Berlin, Germany. The complete electrification of the terminals would involve thirty-eight roads and require four times the number of electric locomotives now in service in America.

NOTES
ON ELECTRICAL TOPICS

Experiments with Wind Power for Kansas Farms.—C. E. Reid, professor of electrical engineering at the Kansas State Agricultural College, Manhattan, is having a windmill specially constructed for the purpose of experiment in generating electricity by wind power. It is believed that the design of windmill now planned will be adapted to drive electrical generators and will thus greatly enhance the power facilities of Kansas farms.

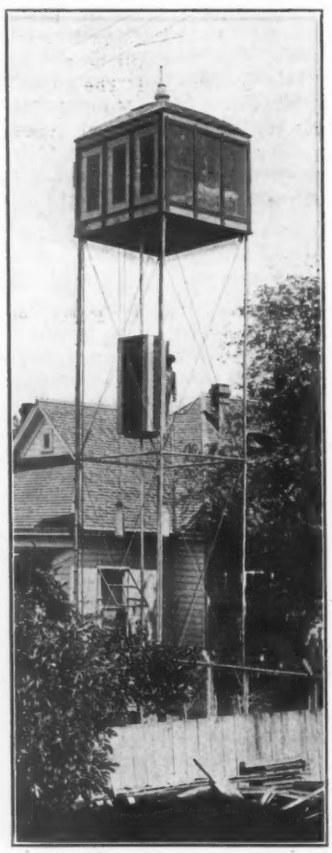
Unification of British Patent Laws Suggested.—In his presidential address to the engineering section of the British Association Dr. Hele-Shaw advocated one comprehensive patent law for the whole of the British Empire. The French law gives an inventor protection in France and her colonies, and the same is true of Germany and her colonies. It is pointed out, however, that France and Germany do not possess colonies or dependencies like Canada, Australia or India, and that the latter are likely to resist any suggestion that they should yield up the power they now possess of granting patents and that England should become the patent authority for the whole empire.

Preventing Oil from Freezing in Transformers. — The Turners Falls Power & Electric Company of Greenfield, Mass., advocates the installation of a small outdoor substation and claims a saving in cost of station and equipment over an indoor type of substation of from 10 to 25 per cent. No depreciation is observed in the insulating quality of oil in the outdoor transformers even in spare units that stand idle in stations nine months of the year. The freezing of oil in outdoor transformers is prevented either by exciting to voltage in cold weather or by the use of internal or external electric heaters. Spare units are usually placed in the circuit idle from Jan. 1 to March 10, this being the period during which the temperature falls below zero.

Saving Seconds in Hunting Telephone Numbers.—The new directory of the New York Telephone Company weighs 8 oz. less than the old one and has 150 fewer pages. It contains, however, 35,000 more names than did the previous edition, the listings now totaling 360,000. The reduction in the size of the book was accomplished by the use of a style of type which is more compact horizontally but expanded vertically. Dr. J. W. Baird of Clark University, an expert on the psychology of optics and printing, has found that the average person can find a number in the new directory in 9.28 sec., whereas 10.35 sec. was required to find a number in the old book. The pages have also been divided into four columns instead of three, and the directory is so bound that it lies flat, no matter where opened. About 660,000 copies went to New York subscribers.

Department of Commerce Wants South American Representative.—The Bureau of Foreign and Domestic Commerce at Washington, D. C., is planning to undertake in the near future an investigation of the trade in electrical machinery, instruments and supplies in South American countries, and wishes, therefore, to get in touch with competent men. A good technical knowledge of the electrical trade and ability to write reports are indispensable. Applicants must have a knowledge of Spanish. While there are on file applications from persons who seem fairly well qualified for this work, it is thought that men possessing more knowledge of the subject who are experienced in investigation work and in making special reports may be available. E. A. Brand is acting chief of the bureau.

An Electric Elevator for an Outdoor Sleeping Apartment.—Because the temperature 40 ft. above the ground is nearly 10 deg. Fahr. cooler than on the earth below, an engineer in Yolo County, Cal., has built himself an outdoor apartment on stilts so that he may sleep in comfort during the hot, sultry nights, says the *Pacific Service Magazine*. The floor of the apartment is 38 ft. above the ground and is reached by an electric elevator using a 1/16-hp. motor. Not only does such a bedroom prove satisfying in a warm climate but its design fits it for use generally as a sleeping porch, particularly for those suffering from any of the diseases which demand outdoor sleeping.



A SLEEPING CAGE 40 FT. ABOVE GROUND REACHED BY ELECTRIC ELEVATOR

Pan-American Scientific Congress.—The Pan-American Scientific Congress will be held in Washington from Dec. 27 to Jan. 7, at which time the delegates appointed by Secretary Lansing will convene. The executive committee of the congress is as follows: William Phillips, Third Assistant Secretary of State, chairman ex officio; James Brown Scott, secretary Carnegie Endowment for International Peace, Washington, vice-chairman; William H. Welch, president National Academy of Sciences, honorary vice-chairman; John Barrett, director-general Pan-American Union; William H. Bixby, brigadier-general, U. S. A., retired; Philander P. Claxton, commissioner of education; William C. Gorgas, surgeon-general, U. S. A.; William H. Holmes, head curator Smithsonian Institution; Hennen Jennings, former president London Institute of Mining and Metallurgy; George M. Rommel, chief of the animal husbandry division, Bureau of Animal Industry, Department of Agriculture; L. S. Rowe, president American Academy of Political and Social Science, and Robert S. Woodward, president Carnegie Institute of Washington. There will be nine main sections, devoted to nine different subjects. General Bixby is in charge of the engineering program. The committee on the conservation of water for power is composed of N. C. Grover, United States Geological Survey, chairman; Herman Stabler, United States Geological Survey; M. O. Leighton, consulting engineeer for the United States Geological Survey; E. C. Finney, attorney for the Department of the Interior, and Philip P. Wells, attorney for the Conservation Commission, all of Washington, D. C. The members of the committee on engineering education are Arthur A. Hamerschlag, director Carnegie Institute of Technology, Pittsburgh, Pa., chairman; Frederick A. Goetze, dean School of Mines, Engineering and Chemistry, Columbia University, New York; G. C. Anthony, dean Engineering School, Tufts College, Massachusetts; R. M. Hughes, president Miami University, Oxford, Ohio; Herman Schneider, dean College of Engineering, University of Cincinnati; Carl L. Mees, president Rose Polytechnic Institute, Terre Haute, Ind., and John B. Whitehead, professor in Johns Hopkins University, Baltimore, Md. Section V, on engineering, will treat of such subjects as relate to water and land transportation and the various problems of interest to the engineering sciences. This section will concern itself in particular with the constructive discussion of various engineering subjects which commanded the attention of the delegates to the Santiago congress of 1908. Among these are a common Pan-American body of engineering nomenclature and laws relating to the use of water. The American Institute of Electrical Engineers will be represented on the engineering committee by F. L. Hutchinson, secretary, New York; Percy H. Thomas, New York; John H. Finney, Washington, and John B. Whitehead, Baltimore, Md.

Athens (Ga.) Electric Club.—The Athens Electric Company started its winter season on Nov. 15 with a large attendance. The speaker of the evening was H. V. Lips, who gave an illustrated lecture on "Edison and the Electric Lamp."

Philadelphia Section, I. E. S.—There will be held on Dec. 17 a joint meeting of the Philadelphia Section of the Illuminating Engineering Society and the Engineers' Club of Philadelphia. Charles P. Steinmetz will speak on "Illuminating Engineering."

Woonsocket Gas and Electric Employees' Club.—On Nov. 18 F. J. Whiting, editor of the Stone & Webster *Public Service Journal*, addressed the Woonsocket (Mass.) Gas and Electric Employees' Club on "International Finance as Affected by the Present War."

Meeting of Wisconsin Contractors.—The thirteenth annual meeting of the Electrical Contractors' Association of Wisconsin will be held in Milwaukee, Jan. 17, 18 and 19, at the Hotel Wisconsin. The only open session of the meeting will be held in the afternoon of Jan. 18.

Los Angeles Section, A. I. E. E.—At the regular meeting of the Los Angeles Section of the American Institute of Electrical Engineers on Nov. 16 in the Chamber of Commerce Building, A. O. Austin, ceramic engineer of the Ohio Insulator Company, presented a paper on "Insulators and Insulator Testing."

Nebraska Electrical Association Annual Convention.—The annual convention of the Nebraska Electrical Association was held at Omaha, Neb., on Nov. 10, 11 and 12. The officers of the association were elected as follows: Mr. Byron of Gothenberg, president; Mr. Smith of Exeter, vice-president; B. E. Egan, Nebraska City, secretary-treasurer; W. C. Ross, Omaha, George Montgomery, Lincoln, and A. C. Laflang, Lexington, executive committee.

Ohio Electrical Contractors' Association.—A most successful meeting of the Ohio Electrical Contractors' Association was held at Columbus on Nov. 10. Reports were received from committees on revision of by-laws, legislation and membership, as well as from W. G. Reuter of Cincinnati, who made an extended report on the Cincinnati Electrical Show. The next meeting of the association will be held the second Wednesday in May, 1916, at Youngstown.

December Meetings.—The following meetings have been announced to be held during December: Central Electric Railway Association meeting at Detroit, Mich., on Dec. 7 and 8; annual meeting of American Society of Mechanical Engineers at New York City, Dec. 7 to 10; joint convention of National Independent Telephone Association and Independent Telephone Association of America at the Hotel LaSalle, Chicago, on Dec. 8, 9 and 10; first annual convention of American Association of Engineers at the Hotel LaSalle, Chicago, Ill., on Dec. 10 and 11; second Pan-American Scientific Congress, Washington, Dec. 27 to Jan. 8.

Associations and Societies

The Directory of Electrical Associations, which is regularly printed in the first issue of each month, appears on page 1289 of this number.

American Society of Agricultural Engineers to Meet in Chicago.—At the annual meeting of the American Society of Agricultural Engineers to be held in Chicago, Dec. 28 to 30, one entire session has been set aside for papers and discussions on the four farm conveniences—lighting, water-works, sewerage and heating systems. Those who will lead the discussions are X. Caverno of Kewanee, Ill., and Burton Ashley, C. E. Roth and L. W. Eggleston of Chicago.

Pittsburgh Section, I. E. S.—An educational meeting was held by the Pittsburgh (Pa.) Section of the Illuminating Engineering Society at the Carnegie Institute of Technology on the evening of Nov. 19. The following papers were presented: "Can Light Be Measured?" by G. W. Roosa; "Instruments That Are Used in Measuring the Quantity of Light," by H. H. Magdsick, and "Instruments That Are Used in Measuring the Quality of Light," by Dr. L. O. Grondahl.

A. I. E. E. to Discuss Motor Control.—The 316th meeting of the American Institute of Electrical Engineers will be held in New York on Dec. 10. The general subject of the meeting will be motor control, and a paper will be presented by C. D. Knight entitled "The Principles and Systems of Electric Motor Control." The paper describes several types of resistors and explains the various forms of magnetic control in vogue for both alternating-current and direct-current motors. The characteristics of contactor or magnetic switch design are also considered.

Joint Meeting of Boston and Providence Engineers.—M. C. Rorty, engineer of the American Telephone & Telegraph Company, New York, addressed a joint meeting of the Providence (R. I.) Association of Mechanical Engineers and the Boston (Mass.) branch of the American Society of Mechanical Engineers at Providence on Nov. 18 upon the development of a national telephone system, over 500 being present. Members of the Boston branch of the A. I. E. E. were also present, about 300 engineers from Boston journeying to and from Providence by special train.

First Convention of American Association of Engineers.—Among those who will speak at the first convention of the American Association of Engineers at the Hotel LaSalle, Chicago, Dec. 10 and 11, are F. H. Newell, professor of civil engineering, University of Illinois; T. B. Lambert, power engineer, Chicago Telephone Company; Richard Yates, ex-Governor of Illinois, and J. H. Prior, chief engineer Illinois State Public Utility Commission. Consideration of ways and means to cooperate with other engineering organizations to advance engineering opportunity is one of the vital points to be discussed. Other engineering societies have been invited to send representatives to take part in the deliberation. Arthur Kneisel, secretary, 29 South LaSalle Street, Chicago, reports that the association now has 260 members. Through the service clearing house 100 engineers have been put in touch with positions in the last two months, although all have not been placed. Of these only forty men were members of the association. At present there is a call for high-grade factory executives.

Cleveland Electrical League.—On Dec. 3 F. M. Feiker, editor of the ELECTRICAL WORLD, was the guest at a meeting of the Electrical League of Cleveland, Ohio, and made an address to that body.

Officers of Electrical Manufacturers' Club.—At the regular meeting of the Electrical Manufacturers' Club held at Hot Springs, Va., last month, the following officers were elected: President, A. W. Berresford of the Cutler-Hammer Manufacturing Company, Milwaukee, Wis.; vice-president, George Morrison, General Electric Lamp Works, Harrison, N. J.; secretary, H. B. Crouse, Crouse-Hinds Company, Syracuse, N. Y.; treasurer, LeRoy Clarke, Safety Insulated Wire Company, New York City. An address was made by James A. Emery, an attorney of Washington, D. C., who discussed a variety of topics pertinent to the occasion.

Brooklyn N. E. L. A. Section Learns of Uses of Gyroscope.—The regular monthly meeting of the Brooklyn Company Section of the National Electric Light Association was held on the evening of Nov. 15, the feature of the program being an interesting address by Elmer A. Sperry, president of the Sperry Gyroscope Company of Brooklyn and member of the United States Naval Advisory Board. Mr. Sperry explained and demonstrated briefly the theory of the gyroscope and then told of its application to stabilizing ships and aeroplanes, to the marine compass, to the sighting of guns, to the aiming of submarines, to telescopes, and to several other devices where precision and stability are necessary.

New York Section Meeting, Society of Chemical Industry.—At the Nov. 19 meeting of the New York Section of the Society of Chemical Industry, held at Rumford Hall, the subject of "Industrial Chemical Research" was discussed in the following papers: "Industrial Argon and Incandescent Lamps," by G. R. Fonda of the research laboratory of the General Electric Company; "Research in Chemical Industry," by C. F. Burges; "Some Principles in the Administration of Industrial Research Laboratories," by R. F. Bacon, director of the Mellon Institute of Industrial Research, and "Chemical Research in the Iron and Steel Industry," by W. H. Walker, director of the research laboratory of applied chemistry of the Massachusetts Institute of Technology.

Public Service Commission News

Arizona Commission

The Arizona Corporation Commission has handed down an order requiring that on or before Jan. 1, 1916, all electric utilities operating in the State shall install such meters or other apparatus as may be necessary in determining the total amount of electrical energy generated and the total amount of electrical energy distributed; that such instruments be read and the energy generated and distributed be determined at frequent and regular intervals, and that permanent records be kept of the results of such readings. In the case of street-lighting circuits and of sign-lighting installations in which a definite amount of electricity is used for a definite number of hours each day, a complete record of such power and such hours of use will be deemed a compliance with the order.

California Commission

Heretofore every gas, water, electric and telephone company in California has enforced its own arbitrary system of rules as to deposits and extensions. This practice was changed on Dec. 1, when the State assumed this power, under the ruling of the California Railroad Commission which fixes standard rules and regulations on this matter to prevail all over the State. The sums now held as deposits run from a few hundred dollars to $400,000, and when the new rule goes into effect over $1,000,000 will be returned to consumers directly or by offsetting bills they owe utilities. More than 600 separate complaints against the deposit system and the refusal of utilities to make extensions were investigated by the commission. Ten months were occupied in the inquiry, which included a close scrutiny of each complaint and an examination into all the rules and practices of about 1000 corporations. Hearings were held at which all the large utilities concerned were represented, and eighteen rules were formulated. These were abstracted in the ELECTRICAL WORLD of Aug. 28. The principal points of the decision are:

(1) An applicant for metered service that is not prepaid, and who is not the owner of the premises, may be required to establish his credit before service by cash deposit, by satisfactory guarantor, or by having paid his bills promptly during 1915. The amount of the cash deposit may be specified by the utility, but must not be over twice the average bill. Residence monthly deposits shall not exceed $2.50 unless the average monthly bill is over $2, when twice the average may be asked. Service must not be discontinued until the deposit is fully absorbed. In both cases consumers billed monthly will not be cut off for fifteen days after written notice; consumers billed weekly, not for four days; fortnightly, until seven days, and those billed for terms longer than monthly periods, not for thirty days. If bills are disputed as to amount, service is to be continued and twice the amount claimed by the utility deposited by the consumer with the Railroad Commission, pending investigation by it. If not so deposited in fifteen days after demand, service may be ended.

(2) Unmetered service at flat rates, if the utility demands, must be paid in advance for the term for which bills are usually rendered. Unmetered service unpaid for may not be stopped except on notice as above.

(3) After a cash deposit has remained unimpaired for a year, it shall be returned to the depositor. All such cases now outstanding must be adjusted by Jan. 1, 1916. Within thirty days after demand all deposits for metered service shall be returned to consumers of less than a year if any of the prescribed guarantees shall be given. When any account is closed any remaining deposit shall be returned promptly.

(4) No contracts may be demanded of consumers, but reasonable written application for service may be. Exceptions are made in unincorporated territory, which matter is yet to be considered by the commission, and in incorporated territory in which contracts may be authorized by the commission.

(5) Service connections of normal size must be made by utilities to the property or curb line, or other point agreed upon, at their expense. Disconnecting and reconnecting service may be charged to the new or resuming consumer, distributed over a period of payments, or merged in the general operating expenses, according to the rules of the utility as authorized by the commission. Cancellation charges, hitherto made, are abolished.

(6) Utilities operating under a general franchise to use all the streets of a city must extend mains to serve applicants. They may appeal to the commission if an undue hardship would thus be caused. Money paid to utilities for extensions is a loan to be repaid as soon as conditions warrant.

Iowa Commission

The secretary of the Board of Railroad Commissioners of the State of Iowa has called our attention to the fact that the ruling on high-tension power lines reported in our issue of Nov. 13, page 1113, was not made by the Iowa commission.

New Jersey Commission

In formally denying to the Newton Gas & Electric Company permission to increase its rates, the Board of Public Utility Commissioners said on Nov. 30 that the service rendered by the company falls far short of safe, adequate and proper service. The conclusion was reached by the board that the proposed schedule of minimum charges for lighting suggested by the company is unjust and unreasonable. In the judgment of the board, the problem of settling the difficulties in securing proper service for Newton from the power company admits of but one solution, and that is the sale of the property in the Court of Chancery, under whose jurisdiction a receiver has been handling the company's affairs.

New York Commissions

Commissioner G. V. S. Williams of the Public Service Commission, First District, New York, has rendered an opinion in the case of J. G. Mayhew and others against the Kings County Lighting Company. The commission has not yet acted upon the recommendation, which is for an order making the rates to be charged for gas from December, 1915, to December, 1916, 95 cents per 1000 cu. ft. The case is an old one and has had an interesting history. The original complaint was filed in 1910, and hearings upon it were held by Commissioner Maltbie. The Kings County Lighting Company supplies gas in the Thirtieth Ward of Brooklyn and at the time was charging $1 per 1000 cu. ft. of gas. The complainants alleged that the rate was unreasonable and requested the commission to order a reduction. After the hearings, the commission issued an order fixing the rate at 85 cents per 1000 cu. ft. from Nov. 1, 1911, to Dec. 31, 1912, and 80 cents per 1000 cu. ft. for the year 1913. The company obtained a writ of certiorari, and the commission's action was reviewed by the court. The Appelate Division held that the commission's decision in regard to the capital investment upon which the company was entitled to a fair return was correct except as to allowances for going value and paving over mains, both of which the commission had disallowed. The Court of Appeals sustained the Appellate Division as to going value, but reversed it and sustained the commission as to paving over mains. The case was remanded to the commission for action in accordance with the court decision and was referred to Commissioner Williams, who held additional hearings and caused the valuation of the company's property made by the commission as of December, 1910, to be brought up to December, 1914.

The Public Service Commission, Second District, New York, has approved extensions of the lines of the Courter Electric Company through the town of Cobleskill under a franchise recently granted by the town authorities. The added electricity for the new lines will be secured through an arrangement with the Mohawk Hydroelectric Company. While there was some objection by residents of the town of Cobleskill to the terms of the Courter company's franchise, Commissioner Emmet indicated on the hearing of the case that if the objections to the terms of the franchise were valid, redress for the objectors lay with the town authorities or the courts rather than with the commission, which is directed by the law to consider the public convenience and necessity of the improvement that is under contemplation.

Corporate and Financial

Great Western Power Company of California, San Francisco, Cal.—The properties of the Great Western Power Company, a corporation operating in California and controlled by the Western Power Company of New Jersey, will be taken over by the Great Western Power Company of California, which has recently filed articles of incorporation with a capitalization of $60,000,000. Mortimer Fleishhacker, president of the Great Western Power Company, in commenting on the incorporation, explained that the new company will take the place of the present Great Western Power Company, through an exchange of the $27,500,000 outstanding stock of the latter company for new common stock. The present Great Western Power will be entirely eliminated and superseded. The new company will issue at once $4,500,000 of ten-year 6 per cent debentures, convertible into preferred stock, and $30,000,000 of the stock of the new corporation will be 6 per cent cumulative preferred. In order to issue this preferred stock it was necessary that a new corporation should be organized. The new company proposes also to issue first and refunding bonds, ultimately to the amount of $100,000,000.

Los Angeles (Cal.) Gas & Electric Company.—The Board of Public Service Commissioners of Los Angeles (Cal.) passed a resolution on Nov. 23 proposing the purchase of the distributing systems of the Pacific Light & Power Company and the Los Angeles Gas & Electric Corporation in the Hollywood and East Hollywood and Eastlake-Highland Park-Garvanza districts, provided a satisfactory price can be agreed upon. If fair terms cannot be secured, the board further resolved that a complete electrical distributing system be installed, paralleling that of the existing corporations. "It appears advisable," said the board, "that provision be made as soon as practicable for supplying municipal power in these two sections in order that the necessary distributing works therein may be ready for use by the time the city's generating plant is completed." The plan of the commissioners is to be submitted to the City Council for approval.

Lykens Valley Light & Power Company, Tower City, Pa.—An issue of $150,000 of first mortgage 6 per cent sinking-fund gold bonds dated Sept. 1, 1915, and due Sept. 1, 1945, are being offered at 97.5 and interest. The company has taken over the Sterling Consolidated Electric Company and the Williams Valley Light & Power Company.

Middle West Utilities Company, Chicago, Ill.—The unsold balance of an original offering of $2,000,000 of ten-year 6 per cent collateral gold bonds due Jan. 1, 1925, is being offered at 95 and interest. The original price was 94.8.

Northern New York Utilities, Inc., Watertown, N. Y.—Authority has been granted to the company by the Public Service Commission for the Second District of New York to issue $76,700 of securities to finance extensions and improvements to its system in and about Watertown. The company will issue $55,500 par value of its 5 per cent fifty-year, first mortgage bonds at 87.5 and $21,200 par value of its 7 per cent cumulative preferred stock at par. The commission has not yet come to a decision on the application of the company to take over the municipal electric plant of the village of Cape Vincent and to issue securities thereon. The case has been consolidated with the one in which the above order has just been made and will be considered in connection with the security issues and other features appertaining to that case.

Northern Ohio Traction & Light Company, Akron, Ohio.—For the first nine months of the calendar year the surplus of the company after interest charges amounted to $613,958, as compared with $610,295 for the first nine months of 1914. Gross earnings ran about $100,000 ahead of last year. A statement showing the comparative results of operation for the first nine months of 1914 and 1915 follows:

	1915	1914
Gross earnings	$2,829,360	$2,728,559
Operating expenses and taxes	1,748,732	1,663,018
Net earnings	$1,080,628	$1,065,541
Interest	466,670	455,246
Surplus	$613,958	$610,295

Northern States Power Company, Chicago, Ill.—Some 350 investors in Minneapolis and St. Paul, Minn.; Fargo, N. D.; Sioux Falls, S. D., and other cities served by the organization have subscribed to approximately $200,000 par value of the company's 7 per cent preferred stock under the plan for increasing the number of stockholders in the territory served by the company's lines. While the partial payment plan is growing in favor, the great majority of sales have been for cash.

Ohio Service Company, Cambridge, Ohio.—Authority has been granted to the company by the Public Utilities Commission of Ohio to issue $88,000 of three-year 6 per cent convertible trust notes and $12,700 of common stock. Of these securities $82,000 are to be sold, the notes at not less than 88.5 and the stock at not less than 80. These issues will enable the company to reimburse its treasury for cash expended in the acquisition of the Strasburg Electric Company and for additions, extensions and improvements to its properties and to make the final payment in the purchase price of the Strasburg company.

Peerless Truck and Motor Corporation, New York, N. Y.—A statement recently made public shows that there has been issued by the company in the acquisition of the capital stock of the Peerless Motor Car Company and the General Vehicle Company, Inc., 200,000 shares of capital stock, par value $50, totaling $10,000,000, and ten-year 6 per cent convertible gold notes to the amount of $5,000,000. There has been deposited with the trustee to retire the balance of the outstanding bonds of the Peerless Motor Car Company $600,000; also there has been deposited with the trustee to acquire the remainder of the outstanding shares of the Peerless Motor Car Company $637,695. Cash in the bank amounts to $292,500. The subsidiary company's assets on Sept. 30, 1915, were $14,362,726.64, of which patents, franchises and good will take up $5,100,000, capital assets $4,664,268.42, current assets $4,389,897.02, and deferred assets $208,561.20. The outstanding capital stock of the Peerless Motor Car Company is $4,186,200, and that of the General Vehicle Company $6,200,000. The funded debt of the subsidiaries for the retirement of which cash has been provided by the new company amounts to $900,000.

San Joaquin Light & Power Corporation, Fresno, Cal.—The California Railroad Commission has recently issued an order authorizing the company to issue three promissory notes for $300,000 at 6 per cent, to refund six promissory notes now overdue. The first and refunding mortgage forty-year series 6 per cent gold bonds of the corporation will be pledged as collateral security for the three new notes, on the basis of $1,333.33 par value of the bonds for each $1,000 face value of the notes secured.

Shawinigan Water & Power Company, Shawinigan Falls, Quebec.—The dividends of the company have been raised from a 6 per cent basis to a 7 per cent basis. The present year, it was stated at the recent directors' meeting, is the best in the history of the company. The increase in dividend rates, it was stated by J. E. Aldred, president of the company, was to have been made a year ago, but action was deferred on account of the European war.

Utah Securities Corporation, Salt Lake City, Utah.—The gross and net earnings of the combined operating properties of the corporation for the month of October and for the twelve months ended Oct. 31 were larger than for any similar period in the history of the properties. The gross earnings for October were $432,601, which is 8 per cent more than for October, 1914, while the net earnings showed a gain of 22 per cent, from $194,436 to $237,687. For the twelve months ended Oct. 31, 1915, the gross earnings amounted to $4,703,796, a gain of 2 per cent, and the net earnings were $2,427,445, a gain of 6 per cent.

Wanatah (Ind.) Electric Company.—The Public Service Commission of Indiana has entered an order empowering the company to sell $9,000 in bonds and $5,000 in stock certificates for the purpose of purchasing the lighting system and transmission lines heretofore installed in Wanatah and to furnish light, heat and power to the town.

Washington Water Power Company, Spokane, Wash.—A new issue of $1,700,000 of first refunding mortgage gold 5 per cent bonds due July 1, 1939, is being offered at par and interest.

Manufacturing and Industrial

The Robbins & Myers Company, Springfield, Ohio, has moved its San Francisco office, which is in charge of C. R. Hunt, to 701 Rialto Building.

The Spray Engineering Company, 93 Federal Street, Boston, Mass., has adopted a trademark and a trade name for its various products. Henceforth its equipment will be designated as "Spraco" air washers, "Spraco" nozzles, "Spraco" cooling systems, etc.

The Tungsten Products Company is the new name of the concern formerly known as the Cleveland Tungsten Products Company, Chester Avenue, N. E., and East Thirtieth Street, Cleveland, Ohio. The company has recently moved into a new factory.

The Shaw Insulator Company, 207 Market Street, Newark, N. J., manufacturer of molded insulation and lightning protective equipment, has recently completed the construction of a plant for molding composition material into insulating parts for generators, motors, automobile starters, magnetos, etc.

New Plant for Novelty Incandescent Lamp Company.—The new St. Mary's plant of the Novelty Incandescent Lamp Company, Emporium, Pa., will be ready for operation about Dec. 15. The capacity of the new factory, which is designated as Plant No. 2, is 5000 tungsten lamps daily. The additional output will enable the company to take care of its increased business.

H. O. Swoboda, Empire Building, Pittsburgh, Pa., has been retained as consulting engineer by the city of Massillon, Ohio, for the purpose of preparing a set of plans and specifications for a new street-lighting system. The present contract with the lighting company of the above-named city expires during the month of April of next year, and it is the desire of the city to secure a modern system of lighting.

Robbins & Myers Company Arranging for Large Addition to Its Factory.—Arrangements are being perfected by the Robbins & Myers Company, manufacturer of motors and fans, Springfield, Ohio, to begin the construction of a new building early in the coming year. The ground dimensions of the structure will be 300 ft. by 300 ft., and it will be four stories high. The addition will require an investment of about $150,000, and it is estimated that about $50,000 will be expended in equipment.

"Ben Franklin Day," Jan. 17.—Jan. 17, 1916, the two hundred and tenth anniversary of the birth of Benjamin Franklin, will be observed by the National Quality Division of the General Electric Company, Nela Park, Cleveland, Ohio, by the distribution of a series of special Franklin window displays, commemorative of the work of the great American philosopher and electrical experimenter. The familiar kite and key are features of the exhibit. Newspaper advertising plates and lantern slides for motion-picture show display are also being distributed by the National Division, in preparation for advance publicity for "Ben Franklin Day."

Roebling Company Acquires Massachusetts Plant.—The John A. Roebling Sons Company, whose plant in Trenton, N. J., was recently damaged by an incendiary fire, has purchased the machinery and equipment of the Spencer Wire Company of Worcester, Mass. The purchase was made to tide the Roebling company over the emergency caused by the fire. The Worcester factory will be used in manufacturing wire rope from material sent from other plants of the Roebling company, and after the plant in Trenton is restored the equipment will be sent to other factories. The Spencer plant is one of the largest power customers of the Worcester Electric Light Company and is situated within a few yards of the Webster Street generating station of the last-named concern.

Russian Society for Electrical Enterprises, Ltd.—The Russian Society for Electrical Enterprises, Ltd., 5 Marsowo Polje, Petrograd, announces that, in addition to its activities as the operator of electric-lighting plants in Pawlowsk, Uman and Kamenetz-Podolsk, and of electric railways in Elizabethgrad and Uman, it has opened a branch for the sale of electrical machinery, apparatus and insulating materials, steam and internal-combustion engines, and water turbines. In this connection the society wishes to act as Russian agent for American manufacturers in the sale of electrical equipment, and would like to get into touch with such manufacturers. Announcement is made that the company is a member of the Russian and French Bank, to which it refers by permission.

Playing a Trump in the Electrical Advertising Game.—The electrical industry is represented by the Western Electric Company, 463 West Street, New York, in a new advertising game recently placed on the market, in the production of which thirteen large distributers of nationally advertised goods collaborated. The game, known as "Going to Market," is modeled after the famous game of authors, the dignified old faces and names of the latter giving place in the new game to the names and products of thirteen diversified manufacturers. Each manufacturer has a set of four cards, making a total of fifty-two for the deck. The game is played exactly like its prototype, with the difference, as explained above, of the substitution of names. The Western Electric Company's four cards are used for washing machines, vacuum cleaners, "interphones" and electric irons.

Banquet for Employees of Benjamin Electric Company.—Fifty-two officers and salesmen of the Benjamin Electric Manufacturing Company, Chicago, Ill., recently attended a banquet given by the company's manufacturing department to the members of the sales and advertising departments of the central division of the concern at the Hotel La Salle. E. A. Drake, factory manager, acted as toastmaster. Addresses were made by R. B. Benjamin, president of the company, and W. D. Steele, vice-president and general manager. Five-minute talks were also made on the following subjects: "Quality of Material and Service in Salesmanship," "The Place of Advertising in Business," "Engineering Department Problems," "The Figuring of Costs," "The Advantage of Bonus Rates in Production," "The Metal Market," "The New Field for the Factory Signal Horn," "The Packing and Labeling of Goods," "The Handling of Orders" and "Educational and Welfare Work Among Employees." The following men took part in the discussion: A. E. Lubeck, G. B. Weber, A. N. Fox, H. Pollard, L. W. Kester, O. F. Westphal, C. B. Harlow, H. A. Varnell, J. Estes, P. Phillips, H. A. Frahm, J. M. Watson, George Thyer, F. Stranberg, C. H. Harrington and C. Vroman.

Data on Activity in the Small-Motor Field.—Frederick S. Dellenbaugh, Jr., a representative of the industrial department of the Westinghouse Electric & Manufacturing Company, speaking before a meeting of Ohio central-station men, presented the accompanying table to show the distribution of inquiries for small motors in the many fields of their usefulness received by the Westinghouse company:

Application	Number of Inquiries	Per Cent of Total
Clothes and dish-washers	48	18.3
Vacuum cleaners	33	12.5
Garage and house pumps	30	11.5
Addressing and mailing machines	18	6.8
Small blowers	18	6.8
Carbonators and beer pumps	17	6.4
Coffee mills and meat choppers	16	6.2
Small machine tools	14	5.3
Adding and computing machines	10	3.8
Electric pianos	10	3.8
Motion-picture machines	8	3.0
Sewing machines	7	2.7
Optical instruments	5	1.9
Humidifiers	4	1.5
Dental supplies	4	1.5
Sign flashers	4	1.5
Miscellaneous	17	6.5
Total	263	100.0

These data do not represent inquiries for one or two machines for users, said Mr. Dellenbaugh, but inquiries from manufacturers, the number being the number of different manufacturers and not the number of inquiries including several from one company. The table does not include all the manufacturers of this apparatus, each one of which is turning out from a few hundred to several thousand machines a year. In addition to the common headings given, there are a number of manufacturers of apparatus such as peanut and popcorn machines, razor-blade sharpeners, vegetable parers, hat cleaners and a host of other motor-driven devices too numerous to mention. As an example of the spread of the motor-driven

idea, a number of unusual and unique devices have recently been developed that usefully fill a certain need that the ordinary person would hardly think provided a field for motors. One of these is a paper shredder for banks. It is quite important that all the waste paper thrown out of banks should be mutilated beyond possible identification. To burn this or otherwise destroy it by hand has been quite a problem in some of the larger institutions, and so some one comes forth with a motor-driven device that tears up the paper as rapidly as it can be thrown in the hopper and leaves it in about the shape of excelsior. Motion-picture ticket venders, ticket destroyers, baseball score boards, and even automatic flagmen for railroad crossings, all driven by small motors, are being manufactured. The data are given with the intention of emphasizing the wide possibilities in the use of small motors.

NEW YORK METAL MARKET PRICES

	Nov. 22 Selling Prices Bid	Nov. 22 Selling Prices Asked	Nov. 30 Selling Prices Bid	Nov. 30 Selling Prices Asked
	£ s d		£ s d	
London, standard spot	82 15 0		79 10 0	
Prime Lake	19.75	to 20.00	19.75	to 20.00
Electrolytic	19.62½	to 19.87½	19.75	to 20.00
Casting	19.12½	to 19.37½	19.25	to 19.50
Copper wire base	20.87½	to 21.12½†	20.87½	to 21.12½†
Lead	5.25		5.25	
Nickel	45.00	to 50.00†	45.00	to 50.00†
Sheet zinc, f.o.b. smelter	20.00†		22.00†	
Tin, Straits	39.62½		39.75†	
Aluminum, 98 to 99 per cent	56.00	to 58.00	57.00	to 59.00

OLD METALS

Heavy copper and wire	16.00	to 16.25†	16.50	to 16.75†
Brass, heavy	10.50	to 11.00†	10.75	to 11.00†
Brass, light	9.00	to 9.25†	9.00	to 9.25†
Lead, heavy	4.50	to 4.75†	4.50	to 4.75†
Zinc, scrap	13.50	to 14.00†	13.50	to 14.00†

COPPER EXPORTS

Total tons to Nov. 30 19,396

†Nominal.

New Incorporations

The Brighton Hydroelectric Company, Brighton, Iowa, has been incorporated with a capital stock of $50,000. The officers are: T. Thompson, president, and Bertha E. Thompson, secretary and treasurer, both of Brighton.

The Farmers' Electric Company of Northern Lancaster County, Pa., has been granted a charter with a capital stock of $5,000. The incorporators are John H. Ware, Clara M. Ware and W. E. Edwards, all of Lancaster. The offices of the company will be in Lancaster.

The Hebron Light, Heat & Power Company, Hebron, Ind., has been incorporated by Fred A. Bremer, Charles B. Alyea, William J. Mulinex, Ralph Alyea and David B. Fickle. The company is capitalized at $25,000 and will generate and distribute electricity.

New Industrial Companies

The Goodman Electric Construction Company, Chicago, Ill., has been incorporated with a capital stock of $10,000 by Lester E. Goodman, Ralph E. Stern and Harold J. Goldberger.

The Riverside Electric Company, Rochester, N. Y., has been incorporated by Norah K. Ward, Edwin L. North and Walter J. Moore. The company is capitalized at $2,000 and intends to do a general contracting business.

The American Sewing Machine & Electrical Company, New York, N. Y., has been incorporated with a capital stock of $1,200 to manufacture and deal in electric motors. The incorporators are Julius Halperin, Abraham Nizin and Irving Silverman.

The G. E. Engineering Company, New York, N. Y., has been incorporated by George M. Wheeler, Lewis J. McDowell and Franklin L. Harris, 6 Ithaca Street, Elmhurst, Long Island. The company is capitalized at $10,000 and will manufacture and deal in electrical machinery.

Trade Publications

Small Lighting Plant.—The Strong Electric Company, Des Moines, Iowa, has prepared an illustrated folder on its farm gasoline-engine-driven generating plant.

Toy Transformers.—An illustrated folder describing several types of its toy transformers has been issued by the Dongan Electric Manufacturing Company, Detroit, Mich.

Christmas-Tree Lighting Battery.—The General Lead Batteries Company, Newark, N. J., has published Bulletin No. 14 on its small batteries for lighting Christmas trees and operating toys.

Mine Suspensions and Clamps.—The Westinghouse Electric & Manufacturing Company, East Pittsburgh, Pa., has prepared an illustrated leaflet, No. 3859, on its mine suspensions and clamps.

Electric Boudoir Set.—The Hotpoint Electric Heating Company, Ontario, Cal., is sending out an attractive booklet in the shape of a small bag which contains information on its electric boudoir set.

Oil Engines.—Bulletin No. 142, describing its recently developed type "D" single-cylinder horizontal oil engine, has been published by the De La Vergne Machine Company, East 138th Street, New York.

Christmas-Tree Outfits.—An illustrated leaflet describing electric lamps and electric candles for Christmas-tree lighting has been published by the Import Sales Company, 19 East Twenty-first Street, New York.

Automobile Batteries.—Handbook RB, issued by the Electric Storage Battery Company, Philadelphia, Pa., contains information on replacement batteries for automobiles, starting, lighting and ignition service.

Ornamental Lighting Fixtures.—The Beardslee Chandelier Manufacturing Company, Chicago, Ill., is sending out Sheets J-5-1 to J-5-6 inclusive, which contain sketches of various types of ornamental lighting fixtures.

Toy Motor and Small Transformers.—The Viking Electric Company, 150 Chambers Street, New York, has prepared illustrated folders describing its transformers for the operation of toys and bells and its "Veco" toy motor.

Electric Trains.—The Lionel Manufacturing Company, 48 East Twenty-first Street, New York, has prepared an attractively illustrated catalog which contains information on its electric toy trains and auxiliary apparatus.

Electric Furnaces.—The Arthur H. Thomas Company, West Washington Square, Philadelphia, Pa., has prepared an illustrated bulletin on electric multiple replaceable-unit furnaces of the muffle, tube, crucible and organic combustion types.

Lighting Standards.—The King Foundry Company, St. Joseph, Mo., has recently published its latest "Monolight" bulletin, which contains a number of illustrations of its lighting standards, employed with General Electric "Novalux" units.

Telegraph Devices.—J. G. Bunnell & Company, 32 Park Place, New York, have prepared the thirty-sixth edition of their Catalog No. 73, which is a manual of wire and wireless telegraphy with descriptions of instruments adapted for use by amateurs.

Hydraulic Apparatus.—The Pelton Water Wheel Company, San Francisco, Cal., is sending out a circular which is illustrated in colors and contains information on various types of hydraulic apparatus and details for analyzing a proposed water-power development. The bulletin is being printed in Spanish, Portuguese and English.

Woven-Asbestos Resistance and Heating Nets.—The Cressall Manufacturing Company, 40 Staniforth Street, Birmingham, England, is sending out a card to which is attached a small sample of its woven-asbestos resistance units. The company is also sending out leaflets on its resistance nets for motor starters and regulators.

Battery-Charging Equipment.—Booklet B, issued by the Cutler-Hammer Manufacturing Company, Milwaukee, Wis., contains information on its "Universal" unit-type garage equipment and other types for vehicle-battery charging, equipment for use in private garages and for charging starting, lighting and ignition batteries on gasoline cars.

New England

BIDDEFORD, ME.—Preliminary steps have been taken by the City Council for the establishment of a municipal electric-light plant. It is suggested that energy to operate the system be obtained from the Pepperell Mfg. Co., which will soon build a power plant near Bonny Eagle and erect transmission lines to Biddeford, to furnish electricity for lamps and motors for its mills in Biddeford.

RUTLAND, VT.—An amendment to the street-lighting contract between the city of Rutland and the Rutland Ry., Lt. & Pwr. Co. has been approved by the Board of Aldermen, which provides for the installation of 100 additional lamps immediately. It is proposed to replace the arc lamps now in use with the new type "C" nitrogen lamps of from 80 cp. to 400 cp.

ST. ALBANS, VT.—The property of the Vermont Pwr. & Mfg. Co., St. Albans, has been purchased by John W. Ogden of Malden, Mass.; Walter R. Dame of Clinton, Mass., and W. H. Tylee of Worcester, Mass., all officers of the Pub. El. Ltg. Co., Boston, Mass., which was recently organized with a capital stock of $320,000. The Vermont Pwr. & Mfg. Co. will soon be merged with the Pub. El. Ltg. Co. and will be operated under that name. The officers of the new company are: W. H. Tylee, president; J. W. Ogden, vice-president, and W. H. Vorce, treasurer. On the retirement of Mr. Vorce the treasurership will be taken by W. R. Dame of Clinton.

BOSTON, MASS.—Bids will be received by the Commonwealth of Massachusetts at Room 6, State House, Boston, Mass. until Dec. 16 for furnishing approximately 50,000 incandescent electric lamps for certain departments of the Commonwealth of Massachusetts. For details see proposal columns.

BROCKTON, MASS.—The directors of the Retail Trade Bureau have adopted a recommendation for the installation of an ornamental lighting system on Main Street, which provides for the erection of 75 nitrogen lamps of 1000 cp., 25 to burn all night and 50 until 1 a. m.

GREENFIELD, MASS.—The Turners Falls Pwr. & El. Co., Greenfield, has awarded contract for installing additional 6000-kw. vertical waterwheel-driven generator, a bank of 10,500-kw., 6600/66,000-volt transformers, and for the necessary extensions to buildings to provide space for this equipment. With this equipment in place the plant will have an output of 24,000 kw. The plant is designed for an ultimate output of 36,000 kw. C. F. Mosher is superintendent of stations.

MERRIMAC, MASS.—A committee has been appointed to make investigations and to determine as to the advisability of purchasing energy from the Amesbury (Mass.) El. Lt. Co. to operate the municipal electric-light system. At present electricity is generated at the municipal plant, but the output is not sufficient to meet the present demands.

HARTFORD, CONN.—The Connecticut Co., Hartford, has applied to the City Council for a permit to rebuild and enlarge its power station on Commerce Street. Four 1000-hp. boilers and a coal conveyor will be installed. The station will be equipped with smoke consumers. The cost of the improvements is estimated at $197,000.

Construction

News of Projects, Plans, Bids and Contracts. Notes on Work Under Way

Middle Atlantic

ALBANY, N. Y.—Bids will be received by the Board of Contract and Supply, Albany, until Dec. 6 for construction of fire-alarm station to be erected on site bounded by Delaware and Myrtle Avenues and Lark and Morris Streets. Separate bids to be submitted on general construction, plumbing and gas work, electric work and heating. The Obenaus & Nichols Co., 119 State Street, Albany, is architect.

BATAVIA, N. Y.—The Genesee Lt. & Pwr. Co., Batavia, has been authorized by the Public Service Commission to issue $10,000 in bonds, of which the proceeds of $5,605 are to be expended for the installation of an electric distribution system in the village of Elba and $4,394 to reimburse the treasury for the expenditure in connection with the acquisition of the distribution system of the United States Gypsum Co. in the village of Oakfield and for extensions and improvements to same.

BINGHAMTON, N. Y.—The Ansco Co., Binghamton, has awarded the contract for engineering work and construction of extensions and improvements to its power plant to the J. G. White Engineering Corpn., 43 Exchange Place, New York. The company manufactures photographic apparatus, cameras, films, etc.

BROOKLYN, N. Y.—Bids will be received by William Williams, commissioner of water, gas and electricity, Room 2342, Municipal Building, New York, until Dec. 13 for furnishing electricity in Brooklyn as follows: For furnishing and maintaining electric-lighting units for lighting public streets, parks and places from Jan. 1, 1916, to Dec. 31, 1916, inclusive; (2) for furnishing electric current for lamps and motors in public buildings and for furnishing and maintaining certain equipment during said period; (3) for performing sundry repair and other work to lighting equipment furnished by the city during said period. Blank forms of bid, proposals and contract, including specifications, can be obtained at the above office. Bids will also be received at the same time and place for reserving and furnishing electrical generating capacity, current and equipment for use of the high-pressure fire-service pumping stations for the year ending Dec. 31, 1916.

DUNDEE, N. Y.—Within the next 30 days the owners of the local electric-light plant expect to erect the first section of new transmission lines, consisting of 3½ miles; also to purchase within the next 30 days line switches and lightning arresters, 7 miles of No. 6 weatherproof, three-braid wire, 1 mile of No. 8 and 1 mile of No. 10 weatherproof, three-braid wire, one 15-kw., 1100/2200-volt step-up transformer, porcelain insulators, cross-arms, line hardware, etc., tape and fixtures. Edward L. Bailey is manager.

JAMAICA, N. Y.—Bids will be received by Maurice E. Connolly, president of the borough of Queens, Borough Hall, Jamaica, until Dec. 10 for furnishing and installing electric-lighting system from panels to outlets, gas-piping fixtures, etc., in the Jamaica town hall. Blank forms and further information may be obtained at the above office.

JAMAICA, N. Y.—Bids will be received by the Board of Health, Department of Health, corner Centre and Walker Streets, New York, until Dec. 7 for furnishing and installing lighting fixtures in a pavilion on the grounds of the Department of Health, Flushing Avenue, near Jamaica, borough of Queens. Plans may be seen and blank forms and further information may be obtained at the office of the chief clerk of the Department of Health.

NEW YORK, N. Y.—Bids will be received by the Board of Health, corner of Center and Walker Streets, New York, until Dec. 10 for furnishing all labor and material necessary to erect and complete an additional elevator in the measles pavilion on the grounds of the Willard Parker Hospital, at the foot of East Sixteenth Street, borough of Manhattan, together with all necessary alterations and other work in connection with its installation. Plans may be seen and blank forms for the above work and further information may be obtained at the above office.

NEW YORK, N. Y.—Bids will be received by C. B. J. Snyder, superintendent of school buildings, Department of Education, Park Avenue and Fifty-ninth Street, New York, until Dec 13 for installing electric equipment in the addition to the alterations in Public School 3, on Grove Street, between Hudson and Bedford Streets, borough of Manhattan. Blank forms, plans and specifications may be obtained at the above office.

OTISVILLE, N. Y.—Bids will be received by William Williams, commissioner, Room 2342, Municipal Building, New York, until Dec. 9 for furnishing high-tension alternating electric current to the tuberculosis sanatorium of the Department of Health at Otisville, town of Mount Hope, Orange County, together with the furnishing and maintaining of certain equipment, including high-tension transmission lines for the year 1916. Blank forms of bid, proposals and contract, including specifications, can be obtained at the above office.

HARRISBURG, PA.—Notice has been given that application will be made to the Public Service Commission for certificate of public convenience authorizing and approving the incorporation of the following companies: The Center Township Lt. Co., Potter Township Lt. Co., Ohio Township Lt. Co., Georgetown Lt. Co., Industry Lt. Co., and the Glasgow Lt. Co. and the Ferry Lt. Co., of Shippingport. With the exception of the last-named company, the companies will operate in the town or borough for which they are named.

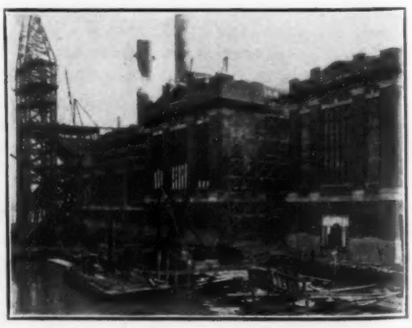
MAUCH CHUNK, PA.—Preparations are being made by the Carbon Transit Co., Mauch Chunk, for the installation of a 300-kw., 600-volt direct-current generating unit, consisting of a generator and engine or turbine (directly connected). Contracts will be awarded about Dec. 1. J. F. Geiser, general manager and electrical engineer, Mauch Chunk, will have charge of the work.

PHILADELPHIA, PA.—The Lehigh Valley R. R. Co., 228 South Third Street, Philadelphia, is contemplating the construction of large shops at Lizard Creek Junction. Electrically driven machinery, it is understood, will be used throughout.

Establishing a Construction Record at the Essex Plant of the New Jersey Public Service Corporation—Eight Months and Eight Days from Foundations to "Steam On"

In the construction of the great new Essex generating station of the Public Service Corporation of New Jersey, now nearing completion at Point-no-Point on the Jersey meadows near Newark, a record was established in getting the plant equipment ready for operation although the building itself had not yet been completed. Exactly eight months and eight days after the picture at the left was taken (on Jan. 21 of this year) the steelwork and superstructure had been run up on the foundations there shown, the prime-mover equipment and auxiliaries had been installed, and the first turbine was turned over, ready to carry its share of the winter lighting load.

Two of the four 25,000-kva. turbo-generators for which the station is designed have been installed, although one of these is considered as a spare unit since the four boilers thus far erected are sufficient to supply steam to only one turbine unit. Each turbine has a direct-connected 100-kw. exciter. Interest has been attracted to the new Essex station on account of its unusual design features, among the most striking of which is the arrangement for reclaiming the energy loses in the generators by conveying the air from the windings to the boiler furnaces. Each generator armature is provided with a number of thermometer coils to indicate the maximum load at which the machine can be operated. The coal-handling equipment is designed for an ultimate station rating of 200,000 kva. Of the complete station, one-third of the boiler house, one-half of the turbine room and one-half of the switch house are being constructed at this time. A short note on this power house was published on page 669 of the ELECTRICAL WORLD of Sept. 18.



PHILADELPHIA, PA.—The directors of the Misericordia Hospital, it is understood, will soon be ready to receive bids for the construction of power house and equipment. The building is to be erected at Fifty-third and Cedar Streets. E. F. Durang & Son are architects.

PHILADELPHIA, PA.—The board of education is planning to erect a four-story school building at B and Westmoreland streets, to cost about $350,000.

PHILADELPHIA, PA.—Bids will be received by the committee on property, board of education, Philadelphia, until Dec. 10 for erecting a 31-room school at B and Allegheny Avenues and also a nine-room addition to the school at Seventieth and Woodland Avenues.

POTTSVILLE, PA.—A movement has been started by the Merchants' Association for the installation of an ornamental lighting system on Centre Street from Nichols Street to the Scheafer Building.

READING, PA.—A site has been purchased at Eighth and Lemons Streets by the Pennsylvania Optical Co., on which it will erect a plant 100 ft. by 230 ft. and also a large power house.

WARREN, PA.—The Warren Lt. & Pwr. Co. is contemplating the installation of a new street-lighting system The plans provide for the erection of ornamental lamps. maintained by underground wires in the business district, 600-cp. lamps to be used in the business section and 250-cp. lamps in the residential districts. J. E. Hill is local manager.

WOODBRIDGE, N. J.—We are informed that the borough of Woodbridge has not granted the Port Reading R. R. Co. a franchise to erect an electric transmission line along the Turtle Brook Road, as reported in the issue of Nov. 20.

DOVER. DEL.—Bids will be received at the office of the supervising architect, Treasury Department, Washington. D. C., until Dec. 22 for installing a new conduit and wiring system and lighting fixtures in the post office at Dover, Del. For details see proposal columns.

WASHINGTON, D. C.—Bids will be received at the office of the supervising architest, Treasury Department, Washington. D. C., until Dec. 23, for installation. complete, of an electric passenger elevator in each of the following buildings: The United States post office and court house at Pendleton, Ore.; post office and court house at Burlington, Vt., and post office and court house at Ardmore, Okla. For details see proposal columns.

WASHINGTON, D. C.—Foreign trade opportunities are announced by the Bureau of Foreign and Domestic Commerce, in the Commerce Reports, as follows: No. 19,321—A report from an American consular officer in Russia states that an organization has requested catalogs, price lists, samples and terms from firms manufacturing electrical supplies, such as carbon for arc lamps, with direct current; material for street lamps, with and without wicks; switches, safety devices, sockets, with and without keys, meters, etc. Correspondence should be in Russian. No. 19,325—An American consular officer in the Canary Islands reports that a business man in his district desires to establish commercial relations, on a commission basis, with manufacturers of electrical appliances. Correspondence should be in Spanish. No. 19,228—A letter to the bureau states that a business man in Peru desires to be placed in communication with exporters or manufacturers of electric hanging and portable lamps of bronze or gilded metal, terra-cotta or imitation marble figures, busts or groups. No. 19,230—An American consular officer in Russia reports that there is an urgent demand for scientific instruments for chemistry, physics, electromechanics, astronomy, mineralogy, geology, zoology, physiology, surgery,' anatomy and meteorology, to be used in educational institutions. No. 19,330—A firm in the United Kingdom informs an American consular officer that it is desirous of importing cotton yarn, suitable for covering electric bell wire, electric flexible cords and cable. Samples of the yarn desired may be examined at the bureau or its branch offices. No. 19,341—A letter to the bureau states that a man in Norway desires to establish commercial relations with manufacturers of automobiles and accessories, electrical materials and machinery for manufacturing pneumatic automobile and cycle tires and tubes, and tin cans for "brisling." No. 19,347—A letter to the bureau states that a firm in Norway would like to communicate with manufacturers of motorcycles and automobile accessories, such as headlamps, lamps, horns, air cocks, lubricators, etc. Further information may be obtained upon application to the Bureau of Foreign and Domestic Commerce, Department of Commerce, Washington, D. C., or its branches.

North Central

BAY CITY, MICH.—The Bay City Electric Light Department has contracted with the Babcock & Wilcox Mfg. Co. for a 600-hp. boiler and three Jones underfeed stokers. The department is in the market for a 20-in. strainer for its suction line and also for a multi-stage centrifugal motor-driven pump for boiler feed. W. H. Fitzhugh is superintendent.

HIGHLAND PARK, MICH.—Work has begun on the installation of an extensive lighting system in Highland Park by the Edison El. Illg. Co. of Detroit. Under the terms of the contract the village has the privilege of taking over the system at the end of ten years.

IRON MOUNTAIN, MICH.—The contract for the addition (48 ft. by 50 ft.) to the power house of the Peninsula Pwr. Co. at Twin Falls has been awarded to G A. Gustafson.

MUSKEGON, MICH.—Preparations are being made by the Terrace Street Improvement Association to install a new ornamental street-lighting system.

CINCINNATI, OHIO.—An addition is being built to the plant of the Buckeye Foundry Co. Some electrical equipment, it is understood, will be required.

CINCINNATI, OHIO.—The contract for the construction of a ten-story addition to the Provident Savings Bank & Trust Company's building has been awarded to H. Harig & Co. The cost is estimated at about $60,000. Electrical and other work will be sublet.

CINCINNATI, OHIO.—The Board of Education has applied for permits to erect the gymnasium and stadium of the new East High School and also the Industrial Arts Building and the power plant. The total cost of the buildings is estimated at about $300,000.

CINCINNATI, OHIO.—Bids will be received by C. W. Handman, business manager of the board of education of the city of Cincinnati, until Dec. 20 for the completion of the new East Side High School buildings, known as the second section, including the power house and equipment. Plans and specifications are on file at 511 West Court Street, copies of which may be obtained upon deposit of $25.

CLEVELAND, OHIO.—Bids will be received at the office of the commissioner of purchases and supplies, City Hall, Cleveland, until Dec. 9 for one motor-driven hose wagon for the division of fire, Department of Safety. Specifications may be obtained on application to the direction of public safety, 207 City Hall, Cleveland.

CLEVELAND, OHIO.—Bids will be received at the office of the commissioner of purchases and supplies, City Hall, Cleveland, until Dec. 9 for furnishing, lighting. extinguishing, repairing, maintaining and furnishing energy for electric lamps for street lighting in the city of Cleveland for the year beginning Jan. 1, 1916. Specifications may be obtained at the office of the superintendent of lighting.

CLEVELAND, OHIO.—Bids will be received at the office of the commissioner of purchases and supplies, City Hall, Cleveland, until Dec. 8 for splicing cable and connecting series transformers in hand-poles for connecting ornamental lighting system for the municipal electric-light department. Specifications may be obtained at the office of the commissioner of light and heat division, 1443 East Third Street.

ELYRIA, OHIO.—The Lorain County El. Co., Elyria, expects to purchase within the next 30 days three 350-kw., 22,000-volt transformers and towers or poles for extensions to its high-tension transmission system. The company is now installing a 4000-kw. General Electric turbine. J. B. Johnson is general manager.

MASSILLON, OHIO.—The light committee of the City Council has engaged H. O. Swaboda, Pittsburgh, Pa., as consulting engineer, to prepare plans and specifications for the installation of a new street-lighting system.

LEXINGTON. KY.—Arrangements are being made by the Kentucky Trac. & Terminal Co. for the erection of new high-tension transmission lines to connect all of the present terminals with a loop system. The new lines will include power-circuit construction from Georgetown to Frankfort and connecting up other high-tension lines already completed. Rights-of-way have practically been secured for the entire work.

SOUTH BEND. IND.—The Public Service Commission has approved rates under which the Indian & Michigan El. Co., South Bend. will supply electrical service in Lakeville.

WESTVILLE, IND.—The Public Service Commission has approved the contract between the Laporte Gas & El. Co., Laporte, and Charles G. Kimble, Laporte, whereby the company will deliver energy at the city limits of Westville. Mr. Kimble proposes to purchase electricity at wholesale and distribute it in the towns of Wanatah, Lacrosse, Kouts, Union Mills and Wellsboro.

CICERO, ILL.—Bids will be received by Andrew H. Burgess, secretary of the board of education, Cicero, until Dec. 13 for electric wiring and for switchboard for a new addition to the J. Sterling Morton High School. Bids will also be received at the same time and place for engines and generators for addition to the J. Sterling Morton High School. Plans and specifications may be obtained at the office of Ashby, Ashby & Schulze, architects, 178 West Jackson Boulevard, Chicago.

DECATUR, ILL.—The contract for the installation of ornamental lamps on North River Street has been awarded to J. P. McGarry, at $3,397. An ordinance providing for the installation of ornamental lamps on East Eldorado Street from Main Street to Front Street has been recommended to the City Council by the board of local improvements. The plans provide for 42 three-lamp standards, to cost about $3,531. Bids, it is reported, will be received the city about Dec. 15 for installing an ornamental lighting system, consisting of 38 standards, carrying three-lamp clusters, on East Main Street and East Eldorado Street. Bids will also be asked about Jan. 10 for an ornamental lighting system on North Main Street, consisting of 76 standards, carrying three-lamp clusters. P. T. Hicks is city engineer.

ELGIN, ILL.—Plans have been prepared by E. A. Bell, city electrician, for the installation of an ornamental lighting system on Charles Street from National Street to Bluff City Boulevard.

GALESBURG, ILL.—The city of Galesburg expects to install a 400-kw. or 600-kw. direct-connected generating unit in the municipal electric-light plant. As yet an engineer has not been engaged. John Walsh is superintendent of water and electric-light plant.

MEDORA, ILL.—The local electric-light plant was recently destroyed by fire. The town is at present without electrical service.

MENOMONIE, WIS.—The local telephone company will remove its poles and wires and place its wires underground in the business district. The cost is estimated at about $28,000.

BRAINERD, MINN.—We are informed that the Pub. Ser. Co. of St. Cloud is building a gas plant in Brainerd. Reported in the issue of Nov. 13 that the company was building a power plant.

CHISHOLM, MINN.—Preparations are being made for an electric haulage system in the Sec. 27 mine of the Oliver Co. The plans call for the installation of an engine and generator, with transmission lines to all parts of the mine where energy is to be used.

ALTON, IOWA.—Bids will be received until Dec. 21 for construction of high and grade school building, including general construction, steam heating, electric wiring, plumbing, temperature regulation, etc., in Alton, to cost about $35,000. Plans are being prepared by Beuttler & Arnold, architects.

ARLINGTON, IOWA.—Plans are being prepared by H. E. Netcot, architect, Independence, for a school building in Arlington, to cost about $30,000. Bids, it is understood, will be received until Jan. 1 for construction, including general construction, heating system, fan system, electric wiring, etc.

DES MOINES, IOWA.—The Des Moines El. Co. has filed a petition with the Council asking for permission to erect an additional high-tension transmission line (44,000 volts) from its power plant to the east city limits over streets and alleys of East Des Moines.

HARLAN, IOWA.—Bids will be received by the board of education, Harlan, until Jan. 5, 1916, for the construction of a new high-school building and a new grade-school building, including general construction, heating and ventilating, heat regulation and electric work. Drawings and specifications are on file at the office of the secretary of the school board, Harlan; at the office of John D. Chubb, architect, Suite 1303, 109 Dearborn Street, Chicago, Ill.; also at the Builders' Exchanges at Des Moines, Iowa; Omaha, Neb.; Kansas City, Mo.; Minneapolis, Minn., and Milwaukee, Wis.

RHODES, IOWA.—At an election to be held Dec. 9 the proposal to grant the Iowa Ry. & Lt. Co., Cedar Rapids, a 25-year franchise to supply electricity in Rhodes will be submitted to the voters.

CROCKER, MO.—The City Council has granted the Crystal Ice & Bottling Co., Crystal, a franchise for the installation of an electric-lighting plant.

FLAT RIVER, MO.—The citizens are planning a campaign to incorporate the town and also to install an electric-light plant and water-works system.

BISBEE, N. D.—The Council is reported to have granted a twenty-year franchise to an electric company to install and operate an electric-lighting system in Bisbee.

NAPOLEON, N. D.—The installation of an electric light plant in Napoleon is reported to be under consideration. J. F. Jacobs and Mr. Woodward, Bismarck, are reported interested in the project.

BRUCE, S. D.—A franchise for the installation of an electric-lighting plant in Bruce has been granted to Weibers & Schulz.

MITCHELL, S. D.—The Mitchell St. Ry. & Interurban Co., recently organized, is investigating the water-power at Great Bend, 78 miles north of Mitchell, with a view of installing a power plant to supply electricity to operate the proposed railway and to furnish electrical service to surrounding towns.

IMPERIAL, NEB.—The installation of an electric-power plant on the Frenchman River is under consideration. James Hoke is reported interested in the project.

LINCOLN, NEB.—Bids will be received by the board of regents of the University of Nebraska, Lincoln, until Dec. 15 for the construction of a chemistry building on the city campus of the University of Nebraska. Separate bids will be received for installation of heating and ventilating, plumbing and vacuum cleaning and electric wiring. Plans and specifications are on file in the office of the superintendent of construction in the administration building of the university. The cost of the building, including equipment, is estimated at $200,000.

LINCOLN, NEB.—Bids will be received by the board of regents of the University of Nebraska, Lincoln, until Dec. 15 for construction of a hospital building on the grounds of the university medical college in Omaha. Separate bids will be received for installation of heating and ventilating, plumbing and vacuum cleaning and electric wiring for said building. Plans and specifications are on file in the office of the superintendent of construction in the administration building of the university, Lincoln. The cost of the building, including equipment, is estimated at $130,000.

VALLEY, NEB.—The Platte Valley Pwr. Co.. Valley, is contemplating extending its transmission lines to Arlington and other towns in that vicinity to supply electrical service. Anton Bortenlanger, Glenwood. is president of the company.

ESKRIDGE, KAN.—The local electric-light plant was damaged by fire. causing a loss of about $1,500.

LITTLE RIVER, KAN.—The city of Little River has awarded contract for the installation of a municipal electric-light plant to F. D. Martin Co., Rialto Building, Kansas City, Mo., at $15,163. W. B. Rollins & Co., Midland Building. Kansas City, Mo., are engineers.

LONGTON, KAN.—Contracts have been awarded by the city of Longton for the installation of a municipal electric-light plant. Riley & Hardman, Parsons, are engineers.

Southern States

DAVISBORO, GA.—Plans for the installation of an electric-light plant have been prepared by W. Hopson Goodloe, American National Bank Building, Macon, Ga. The proposal to issue bonds will be submitted to the voters.

LAKELAND, FLA.—Bids will be received by the Board of Bond Trustees, Lakeland, until Dec. 17 for furnishing material for construction and equipment for additions to fire, water and electric systems, separate bids to be submitted for the following: One quadruple combination motor fire truck, etc., one fire-alarm system and connections, water-works pumps. one air compressor and air lifts, one artesian-well pump, drilling and casing one artesian well, two water-tube steam boilers, one steam-driven electric generating unit, one surface condensing equipment, one switchboard. etc., cast-iron water pipe, fittings, valves and hydrants and laying of same. Specifications are on file in the City Hall, Lakeland, and at the office of the Scofield Engineering Co., Commercial Trust Building, Philadelphia, Pa.

ST. PETERSBURG, FLA.—Bids will be received at the office of the supervising architect, Treasury Department, Washington, D. C., until Dec. 30 for construction complete, including mechanical equipment and approaches, of the United States post office at St. Petersburg, Fla.

MARKS, MISS.—A franchise has been granted to James Fitzel to install and operate an electric-lighting system in Marks.

CHURCH POINT, LA.—The City Council is considering the question of installing a municipal electric-light plant and water-works system.

EL PASO, TEX.—The Commissioners of El Paso County have awarded contract to J. E. Morgan, El Paso, for the construction of court house. exclusive of auditorium, power plant, jail, elevators, wiring. etc., at $364,971; also a contract to the National Telagraphone Sup. Co., El Paso, for wiring court house, auditorium and jail. at $16,000. Trost & Trost, Mills Building, El Paso, are architects.

NORTH PLEASANTON, TEX. — The North Pleasanton Ice & El. Co. is planning to construct an electric-light plant in North Pleasanton, to cost about $25,000. L. B. Myers is interested in the company.

Pacific States

SEATTLE, WASH.—The commissioners of Pierce County have granted the Puget Sound Trac., Lt. & Pwr. Co., Seattle, a blanket franchise to erect transmission lines on the county roads and intersections in the upper Puyallup Valley.

SEATTLE, WASH.—Bids will be received at the office of the Port Commission of Seattle, Bell Street Warehouse, Seattle, until Dec. 15, for construction of refrigerating and electrical equipment for east waterway terminal improvement of the port of Seattle. Plans and specifications are on file in the above office. C. E. Remsberg is secretary.

VANCOUVER, WASH.—The North Coast Pwr. Co., which recently took over the southwest Washington properties of the Washington-Oregon Corpn., it is reported, is making arrangements to erect an electric transmission line from Woodland to Vancouver, Wash. The proposed line, according to report, will pass through Ridgefield and La Center, and will necessitate the rebuilding of the transmission line from Kalama to Woodland. The new line will connect the company's plant at Vancouver with other plants north of Woodland.

SUBLIMITY, ORE.—The city of Sublimity has granted C. E. Taylor, of the Stayton El. Lt. Co., Stayton, a franchise to install and operate an electric light and power system here for a period of 25 years. The company has also secured a five-year contract for lighting the streets of the town.

LOS ANGELES. CAL.—The Public Service Commission has authorized F. L. Roehrig. architect, to prepare plans and specifications for the central power substation to be erected in Los Angeles, at a cost of $50,000. This station will be situated on city property on the west side of the Los Angeles River, south of Main Street bridge; it will receive electrical energy from the aqueduct power plant and will be the main distributing station in the city.

SAN MATEO, CAL.—W. B. Lawrence, superintendent of the Spring Valley Wtr. Co., has submitted a proposal to the Board of Supervisors offering to supply electricity to the County Farm and Hospital. The company is contemplating the erection of an electric transmission line from San Mateo to its plant at Crystal Springs Lakes. The cost of the proposed line is estimated at $2,700.

VICTORVILLE, CAL.—The Southern Sierras Pwr. Co. has secured a contract to furnish the new cement plant of the Southwestern Portland Cement Co. at Victorville with energy to the amount of 2000 hp. for a period of 20 years. L. D. Gilbert is chief engineer of the Southwestern Portland Cement Co.

HAILEY, IDAHO.—A franchise has been granted to Richard W. Ferris to construct and operate an electric-light plant and water-works system in Hailey.

POCATELLO. IDAHO.—The city of Pocatello is contemplating extensions to the street-lighting system, to cost about $35,000. J. H. Giles is city engineer.

MONTICELLO, UTAH.—Steps have been taken to install an electric-light plant and water-works system in Monticello. The stockholders of the Blue Mountain Irrigation Co. have agreed to finance and install the proposed systems.

SPRINGVILLE, UTAH.—The Commissioners of Utah County have granted John D. Childs and others a franchise to erect an electric transmission line and telephone line from Springville to Spanish Fork. Mr. Childs and associates are planning to build a power plant near Springville.

PHOENIX, ARIZ.—The State Corporation Commission has issued an order that all electrical companies in Arizona must install meters by Jan. 1, 1916. Exceptions are made as to street lamps and electric signs for which a definite amount of electricity is used a certain number of hours each month.

ANACONDA, MONT.—The development of its zinc properties is under consideration by the Anaconda Copper Mining Co., and the locations of the electrical zinc plants are being considered by the officials of the company. The operation of the proposed plants, it is said, will absorb all of the power now developed and unsold by the Montana Pwr. Co. at Great Falls. Additional power for any further increase in the zinc plants will be secured from sites already acquired but not yet developed.

WHEATLAND, WYO. — Improvements are contemplated to the municipal electric-lighting plant, involving an expenditure of from $6,000 to $10,000. They will include the purchase of a new steam engine and two boilers, bids for which will be called for at once. The installation of a new generator is contemplated in the near future.

LIBERTY, COL.—The city of Liberty is contemplating the installation of a municipal electric-lighting plant.

LIMON, COL.—Application has been made to the City Council by W. J. Cowhick, Pueblo, for a franchise to install and operate an electric-light plant in Limon.

Canada

VANCOUVER, B. C.—The City Council is contemplating the installation of cluster lamps in Upper Tipperary Park, lying between Third and Fourth Streets.

AGINCOURT, ONT.—Preliminary arrangements. it is understood, have been made to make connection with the system of the Ontario Hydro-Electric Power Commission at Duncan on the Canadian Northern Railroad to secure electrical service for the village of Agincourt.

COLLINGWOOD, ONT.—Negotiations are under way between the local water and light commission and the Ontario Hydro-Electric Power Commission in regard to the erection of an electric transmission line from Eugenia Falls to Collingwood.

FOREST, ONT.—The installation of a hydroelectric lighting and power system is under consideration by the Town Council.

GALT, ONT.—The installation of two motors (to cost about $5,000) at the pumping plant of the water-works system is under consideration.

LONDON, ONT.—Plans are being considered for extensions to the street-lighting system, to cost about $10,000.

ORANGEVILLE, ONT.—A by-law has been passed by the county guaranteeing the bonds of the corporation of the town of Orangeville to the amount of $33.000 for the purchase of the local plant, owned by the Pine River Lt. & Pwr. Co.. and to provide funds for the installation of a distribution system for energy to be supplied by the Ontario Hydro-Electric Power Commission.

SUDBURY, ONT.—The Town Councils of Sudbury and Copper Cliff are considering the question of lighting the road between the two places (a distance of 14 miles).

TORONTO, ONT.—A contract has been placed by the Toronto Hydro-Electric System with the Eugene F. Phillips Electrical Works for furnishing and installing 8 miles of 250,000-circ. mill. three-conductor, paper-insulated, lead-covered 13,200-volt cable.

Miscellaneous

JUNEAU, ALASKA.—Improvements are contemplated by the Juneau Gold Mining Co., Juneau, which will involve an expenditure of $1,500,000 and will include the installation of two crushers, tube mills, two compressors, classifiers, concentrators and construction of power plant, at a cost of $500,000. When completed the power plant will have an output of 5000 hp. The headquarters of the company are at San Francisco, Cal. Fred W. Bradley is manager.

PANAMA.—Bids will be received at the office of the general purchasing officer, the Panama Canal, Washington, D. C., until Dec. 13. for furnishing the following supplies: For motor-driven centrifugal pumps, cast-iron bollards, pinions, steel cable, cold shuts. aluminum pig. stocks and dies, reamers, twist drills, steam whistles, etc. Blanks and general information relating to this circular (No. 993) may be obtained at the above office and at the offices of the assistant purchasing agents, 24 State Street. New York, N. Y.; 614 Whitney-Central Building. New Orleans, La., and Fort Mason, San Francisco. Cal.

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WISCONSIN ELECTRICAL ASSOCIATION. Secretary, George Allison, 1410 First National Bank Building, Milwaukee, Wis.

1,161,015. CAR TRUCK; W. S. Adams, Philadelphia, Pa. App. filed Nov. 17, 1914. Has a combination of leaf and coil springs.

1,161,021. AUTOMATIC STARTER FOR ELECTRIC MOTORS; L. Bradley, Milwaukee, Wis. App. filed Aug. 10, 1911. Has variable-resistance column.

1,161,035. SIGNAL-LAMP SYSTEM FOR CARS; C. C. DeWitt, Shrewsbury, Mo. App. filed March 8, 1915. Thrown into operation when trolley leaves wire.

1,161,036. ELECTRIC FUSE; L. W. Downes, Providence, R. I. App. filed May 17, 1913. Refillable cartridge fuse with blade terminals.

1,161,046. ELECTRIC SWITCH WALL CASE; M. Guett, Hartford, Conn. App. filed June 23, 1914. Adjustable attaching ears.

1,161,048. TELEPHONE SYSTEM; H. L. Harris, Elyria, Ohio. App. filed Aug. 2, 1911. Private branch.

1,161,073. ELECTRIC RELAY; H. A. Parrish, Kalamazoo, Mich. App. filed Sept. 23, 1914. Operable on normally open or closed circuits.

1,161,080. INSULATOR; F. M. Spicer, Quincy, Mass. App. filed June 27, 1913. Rotatably confined on the insulator pin.

1,161,082. TESTING DEVICE; E. S. and C. D. Stewart, Ottawa, Ill. App. filed May 26, 1913. Linemen's set.

1,161,105. PRINTING-TELEGRAPH RECEIVER; C. G. Ashley, Chicago, Ill. App. filed Feb. 23, 1911. Automatic system.

1,161,126. SELECTOR FOR TELEPHONE PLANTS; G. Grabe, Nikolassee, near Berlin, Germany. App. filed Oct. 15, 1913. Locking of the selector.

1,161,130. INDICATOR FOR VEHICLES; L. J. Horan, Detroit, Mich. App. filed July 11, 1913. Visual and audible signals indicate intended movements.

1,161,142. WIRELESS COMMUNICATION; C. V. Logwood, Palo Alto, Cal. App. filed Feb. 12, 1912. Electrical oscillations act directly on telephone receiver or relay, etc.

1,161,146. ELECTRIC HEATING PAD; N. E. Mann, Columbia, Pa. App. filed June 23, 1915. Thermostatic control.

1,161,150. COMBINED BUSHING AND CLAMP FOR ELECTRIC CABLES; O. Moessner, Philadelphia, Pa. App. filed Aug. 6, 1913. Resilient clamp for armored cables.

1,161,173. ARC-LAMP ELECTRODE; E. J. Watzl, Cleveland, Ohio. App. filed April 14, 1913. Fused oxides of titanium, tungsten and the rare earths.

1,161,192. MOUNTING STRUCTURES FOR ELECTRICAL CONDUCTORS; F. B. Cook, Chicago, Ill. App. filed Dec. 26, 1914. Conducting strips with insulation molded thereabout.

1,161,195. LIGHTNING ARRESTER; F. B. Corey, Edgewood, Pa. App. filed Jan. 23, 1915. Not injured by heavy induced discharge.

1,161,196. TELEPHONE-EXCHANGE SYSTEM; E. R. Corwin, Chicago, Ill. App. filed July 15, 1912. Operator-controlled magnetic switches of less number than the telephone lines.

1,161,214. TELEPHONE-EXCHANGE SYSTEM; E. E. Hinrichsen, New York, N. Y. App. filed June 12, 1915. Improved trunk circuit.

1,161,226. ELECTROPLATING APPARATUS; W. F. Koken and H. J. Richards, St. Louis, Mo. App. filed Oct. 19, 1914. Produces better deposit in less time than with a "still" plating process.

1,161,233. STARTING SWITCH; S. J. Leveen, Rock Island, Ill. App. filed Oct. 15, 1913. Protective devices bridged or cut out at starting.

1,161,238. X-RAY CONTROL DEVICE; W. Meyer, Chicago, Ill. App. filed March 15, 1915. Control for intensity and time of exposure.

1,161,278. AUTOMATIC CIRCUIT-BREAKER; A. R. Anderson, Columbus, Ohio. App. filed March 22, 1915. Locking means prevents automatic reclosing of circuit until disappearance of the potential generated.

1,161,299. MAGNETIC SEPARATOR; R. M. Folsom, Reading, Mass. App. filed March 10, 1915. Removing iron scraps from coal which is being fed to a breaker.

1,161,320. ELECTRICAL PROTECTIVE DEVICE; A. J. Loguin, Norwood, Ohio. App. filed March 23, 1912. Has time-element means.

1,161,322. PRIMARY ELECTRIC BATTERY; G. A. Lutz, Plainfield, N. J. App. filed Dec. 6, 1909. Cupric oxide negative element.

1,161,341. TIME STAMP; A. A. Radtke, Chicago, Ill. App. filed Nov. 13, 1909. Improved means for winding the ribbon.

1,161,351. MAGNETIC ORE SEPARATOR; S. N. Smith, New York, N. Y. App. filed Feb. 8, 1915. Removing finely divided ore gangue.

Record of Electrical Patents

Notes on United States Patents issued Nov. 23, 1915, prepared by Mitchell & Allyn, 41 Park Row, New York.

1,161,361. ELECTRIC SWITCH; A. A. Tirrill, Schenectady, N. Y. App. filed Oct. 28, 1909. Pull flush switch.

1,161,362. ELECTRIC SWITCH; A. A. Tirrill, Athens, Pa. App. filed June 24, 1910. Pull type with indicator.

1,161,366. PROCESS OF WELDING METALS; S. W. Wohlrab, Maple Falls, Wash. App. filed April 3, 1915. Feeds finely divided metal under pressure of non-oxidizing gas.

1,161,395. VOLT-AMPERE METER; P. M. Lincoln, Pittsburgh, Pa. App. filed June 19, 1914, showing maximum demand.

1,161,397. BRUSH-HOLDER; L. R. Lord, Delagua, Col. App. filed Aug. 20, 1914. Sheet-metal construction.

1,161,398. STORAGE BATTERY; J. O. Luthy, San Antonio, Tex. App. filed Feb. 26, 1913. Electrolyte contains silver chloride.

1,161,400. IGNITING DEVICE FOR EXPLOSIVE ENGINES; W. J. Martin, Buffalo, N. Y. App. filed April 22, 1915. Has a plurality of substitutable plugs.

1,161,411. TELEPHONE-EXCHANGE SYSTEM; L. Polinkowsky, Brussels, Belgium. App. filed Aug. 17, 1914. Test circuit for automatic switches.

1,161,425. ALTERNATING-CURRENT VAPOR LAMP; P. H. Thomas, Montclair, N. J. App. filed May 11, 1905. Tilting starting means.

1,161,434. MAGNETO-ELECTRIC MACHINE; F. Baier, Chicago, Ill. App. filed March 7, 1910. For ignition purposes.

1,161,454. METHOD OF MAKING ELECTRIC-LIGHT STREAMERS; J. A. Covit, New York, N. Y. App. filed March 12, 1915. Lamp sockets hermetically sealed.

1,161,474. TROLLEY-WIRE CLAMP; W. D. Hall, Port Huron, Mich. App. filed Sept. 20, 1913. Two-part-clamp suspended from a messenger wire.

1,161,477. CIRCUIT CONTROLLER; A. J. Horton, White Plains, N. Y. App. filed Jan. 18, 1912. For motor-driven printing presses.

1,161,485. VAPOR-ELECTRIC DEVICE; M. A. E. Leblanc, Suresnes, near Paris. App. filed March 18, 1913. Lighting tube with receptacles open to atmosphere.

1,161,520. QUENCHED SPARK-GAP; R. Pfund, New York, N. Y. App. filed Dec. 30, 1913. Uses spacing washers or gaskets of metal. (Fifty-six claims.)

1,161,543. CONTINUOUS BRAKE; W. R. Smith, Braeside, Chalfont St. Peter, England. App. filed May 20, 1915. Electrically controlled air valves.

1,161,555. IGNITER FOR INTERNAL-COMBUSTION ENGINES; J. A. Warren, Sumter, S. C. App. filed Oct. 8, 1913. Make-and-break type.

1,161,575. PREVENTION OF DISTURBING VIBRATION; A. Aichele, Baden, Switzerland. App. filed Feb. 15, 1913. Applied to machines having a pulsating torque.

1,161,576. LIQUID RESISTANCE; A. Aichele, Baden, Switzerland. App. filed Dec. 26, 1913. Subjected to a cycle comprising evaporation and condensation.

1,161,582. ELECTRICAL FITTING; W. F. Anklam, Detroit, Mich. App. filed Sept. 8, 1914. Socket fitting for vehicle lamps.

1,161,585. ELECTROLYTIC PRODUCTION OF SODIUM ALLOYS; E. A. Ashcroft, London, England. App. filed Nov. 22, 1913. Subjects electrolyte of molten sodium hydroxide to electrolysis.

1,161,594. CIRCUIT CLOSER; J. E. Bishop, Fitzgerald, Ga. App. filed May 19, 1914. Thermostat construction.

1,161,596. HEATING SYSTEM; E. F. Bliss, Schenectady, N. Y. App. filed Aug. 5, 1915. For electric cars.

1,161,602. OVERFLOW TRUNKING SYSTEM; C. C. Bradbury, Mount Vernon, N. Y. App. filed July 25, 1914. For automatic telephone exchanges.

1,161,608. SEMI-MECHANICAL TELEPHONE-EXCHANGE SYSTEM; A. M. Bullard, New York, N. Y. App. filed Feb. 5, 1907. Capable of high speed and great precision. (Thirty-eight claims.)

1,161,615. CALL-DISTRIBUTING TELEPHONE SYSTEM; H. P. Clausen, Mount Vernon, N. Y. App. filed Feb. 9, 1915. Operator automatically informed of the calling subscriber's number.

1,161,634. ELECTRIC FURNACE; A. Dow, Detroit, Mich. App. filed May 29, 1914. Resistor formed by granular material.

1,161,639. LOUD-SPEAKING RECEIVER; H. C. Egerton, Ridgewood, N. J. App. filed Oct. 12, 1911. Employs a solenoid coil in place of a bobbin.

1,161,655. AUTOMATIC TELEPHONE EXCHANGE; C. L. Goodrum, Urbana, Ohio. App. filed May 1, 1909. Distribution of incoming calls.

1,161,656. PROTECTIVE DEVICE; V. E. Goodwin, Schenectady, N. Y. App. filed July 9, 1912. Electrolytic condenser type for 90,000 volts.

1,161,663. TIME-CONTROLLED PROTECTIVE SYSTEM FOR RAILWAYS; C. Hansel, Cranford, N. J. App. filed May 6, 1908. Speed-regulation signal.

1,161,667. ELECTRIC HEATING AND COOKING STOVE; L. P. Hays, Idaho Springs, Col. App. filed Dec. 5, 1914. Electric coil within air-circulating chamber.

1,161,668. ELECTRIC BATTERY; G. P. Heinrich and J. E. Dunn, Brooklyn, N. Y. App. filed March 18, 1915. Particularly for flashlamps.

1,161,670. HIGH-TENSION CONVERTER SYSTEM; P. C. Hewitt, New York, N. Y. App. filed March 14, 1906. Free from short-circuits.

1,161,681. CAR-AXLE LIGHTING; R. C. Hull and J. L. Woodbridge, Philadelphia, Pa. App. filed July 13, 1909. Uses two opposing exciting circuits.

1,161,708. ALARM APPARATUS; W. McCleary, Hammond, Ind. App. filed Aug. 29, 1914. For showing the escape of illuminating gas.

1,161,716. ELECTRIC SWITCH; E. B. Merriam, Schenectady, N. Y. App. filed June 23, 1911. Oil-switch construction.

1,161,723. PROTECTIVE DEVICE FOR CABLES; W. Pfannkuch, Berlin-Niederschönweide, Germany. App. filed Nov. 3, 1914. Protection against short-circuits.

1,161,734. ART OF ELECTRIC TELESCOPY; B. Rosing, Petrograd, Russia. App. filed April 5, 1911. Transmission of luminous pictures.

1,161,746. LIQUID RHEOSTAT; G. Squire, Halensee, Germany. App. filed Nov. 20, 1914. Insures good circulation of the liquid.

1,161,748. ELECTRIC-HEAT STORAGE SYSTEM; W. Stanley, Great Barrington, Mass. App. filed Dec. 21, 1912. Energy supplied continuously at low rate throughout the day.

1,161,750. APPARATUS FOR THE TREATMENT OF FLUIDS WITH COAGULENTS; A. P. Strohmenger, London, England. App. filed Sept. 30, 1914. Accelerates deposition of foreign matter.

1,161,752. ELECTRIC SWITCH; G. B. Thomas, Bridgeport, Conn. App. filed April 8, 1914. Rotary snap construction.

1,161,783. TELEPHONE TRUNK-RELEASE SYSTEM; J. L. E. Meyer, Chicago, Ill. App. filed June 28, 1909. Release magnet energized from a local ground.

1,161,801. VAPOR-ELECTRIC APPARATUS; E. E. Darmois and M. E. Leblanc, Paris, France. App. filed April 11, 1913. Alternating instead of unidirectional.

1,161,819. MAGNETIC CONTROLLING DEVICE; H. Grob, Zurich, Switzerland. App. filed Nov. 4, 1914. Sensitive but powerful in action.

1,161,820. HIGH-TENSION CONVERTER SYSTEM; P. C. Hewitt, Ringwood Manor, N. J. App. filed March 14, 1906. Has a metallic band outside throat portion of container.

1,161,822. TERMINAL CONNECTION FOR ELECTRIC LAMPS; F. G. Keyes, East Orange, N. J. App. filed Feb. 11, 1914. Detachable junction.

1,161,823. TERMINAL CONNECTION FOR LAMP FILAMENTS; F. G. Keyes, East Orange, N. J. App. filed Nov. 5, 1914. For tungsten filaments.

14,015 (reissue). CONDENSER ARRANGEMENT; A. R. Bullock, Cleveland, Ohio. App. filed March 19, 1913. (Original patent No. 1,048,034, dated Dec. 24, 1912.) Applied to mechanical current-transforming device.

14,020 (reissue). ELECTRIC CONNECTOR; J. C. Stearns, Worcester, Mass. App. filed Aug. 4, 1914. (Original patent No. 1,096,138, dated May 12, 1914). Has rubbing contacts.